MU163220A
3.2G Pulse Pattern Generator Unit
and
MU163240A
3.2G Error Detector Unit
Operation Manual

Seventh Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

Document No.: M-W1386AE-7.0

JUL.
2000

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meaning of the symbols BEFORE using the equipment.

(Some or all of the following symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.)

Symbols used in manual

DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and/or in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle

This indicates an obligatory safety precaution. The obligatory operation is indicated in or near the circle

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described In the box.

These indicate that the marked part should be recycled.

MU163220A 3.2G Pulse Pattern Generator
and MU163240A 3.2G Error Detector
Operation Manual

20 August 1998 (First Edition)
20 June 2000 (Seventh Edition)

Copyright © 1998-2000, ANRITSU CORPORATION
All rights reserved. No part of this manual may be reproduced without the prior written permission of the publisher.
The contents of this manual may be changed without prior notice.
Printed in Japan

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, National Research Laboratory and the Communication Research Laboratory, and was found to meet the published specification.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of- charge if malfunction occurs within 1 year after shipment due to manufacturing fault, provided that this warranty is rendered void under any or all of following condition.

- The fault is outside the scope of the warranty conditions described in operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumable, etc.
- The fault is due to use of non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for faults due to unforeseen and unusual circumstances, nor faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a faults, contact Anritsu Corporation or its representatives at the address in this manual.

Waste disposal

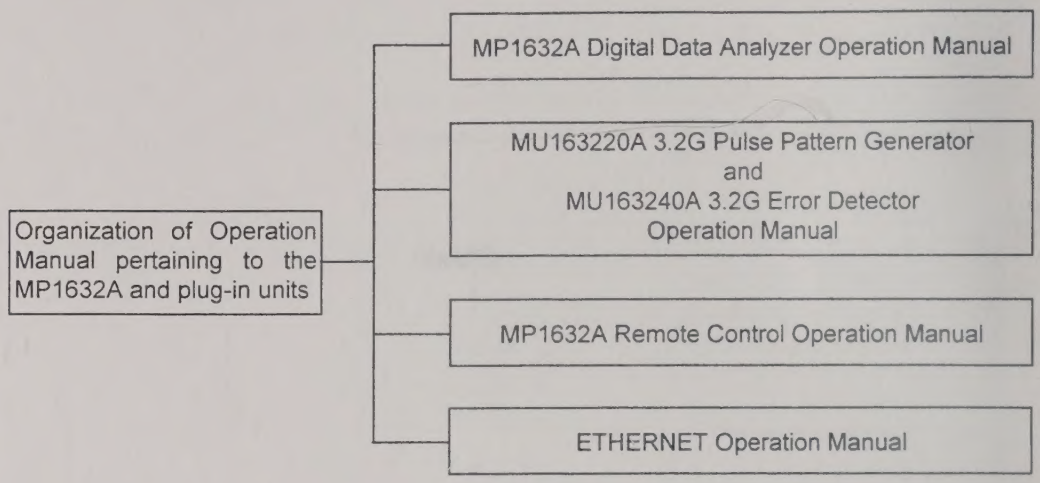
This equipment uses a GaAs.
Check with your local solid waste officials for details in your area for proper disposal.

(Blank)

INTRODUCTION

Organization of Operation Manuals

The MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector are the plug-in units which are inserted into MP1632A Digital Data Analyzer. Operation manuals are prepared for the main unit and the other units, respectively, and consist of the following four operation manuals. Read the operation manual of the unit you are going to use.


Organization of Operation Manual pertaining to the MP1632A and plug-in units
MP1632A Digital Data Analyzer Operation Manual
MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector Operation Manual
MP1632A Remote Control Operation Manual
ETHERNET Operation Manual

- MP1632A Digital Data Analyzer Operation Manual
  This manual describes a brief overview, preparations before starting operation, the panel, specifications, performance, and operation procedures of the MP1632A and the internal 3.2G synthesizer option.
- MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector Operation Manual
  This manual describes a brief overview, specifications, performance, and operation procedures related to the units of the 3.2G pulse pattern generator and the error detector.
- MP1632A Remote Control Operation Manual
  This manual describes the controls using the external interface (RS-232C, GPIB option or ETHERNET option) and sample programs.
- ETHERNET operation manual
  This manual describes how to connect the MP1632A connect to LAN, using FTP, sample program which controls MP1632A via ethernet.

CONTENTS

CHAPTER 1 INTRODUCTION 1

1.1 Product Overview 2

1.2 Organization of the Operation Manual 3

1.3 Equipment Configuration 4

1.4 Specifications 5

1.4.1 MU163220A 3.2G Pulse Pattern Generator 5

1.4.2 MU163240A 3.2G Error Detector 7

CHAPTER 2 PRECAUTIONS 9

2.1 Environmental Conditions of Installation Site 10

2.2 Safety Precautions 11

CHAPTER 3 PANELS AND CONNECTIONS 13

3.1 Panel Layout and Explanation of Panel 14

3.1.1 MU163220A panel layout 14

3.1.2 MU163240A panel layout 15

3.2 Connections between Units 16

3.3 Connecting External Equipment 17

CHAPTER 4 SCREEN CONFIGURATION 19

CHAPTER 5 BASIC OPERATIONS 21

5.1 Setting a Send/Receive Pattern 22

5.1.1 Selecting a send/receive pattern 22

5.1.2 Setting the PRGM pattern 24

5.1.3 Setting the PRBS pattern 25

5.1.4 Setting the zero substitute pattern 27

5.2 Creating/Editing a Pattern 28

5.2.1 Selecting the display mode 28

5.2.2 How to edit in Time display mode 30

5.2.3 How to edit in Table display mode 32

5.2.4 Selecting the areas 34

5.2.5 Pattern input 36

5.2.6 Edit commands 37

5.2.7 Panel key and keyboard operations 39

5.2.8 PRGM Saving a PRGM pattern 40

5.2.9 Opening the PRGM pattern 41

5.2.10 Printing the pattern 42

5.3 Sending/Receiving the Burst Pattern 44

5.3.1 Sending the burst pattern 44

5.3.2 Receiving the burst pattern 46

5.4 Setting the Amplitude/Offset Level/Termination/Phase 48

5.4.1 Setting the Data output interface 48

5.4.2 Setting the Clock output interface 50

5.4.3 Setting the Data input interface 52

5.4.4 Setting the Clock input interface 54

5.5 Synchronizing with the Receive Pattern 56
5.5.1 Selecting a synchronization method 56
5.5.2 Synchronizing with the receive pattern 57

5.6 Auto Searching 59

5.7 Measuring Errors/Alarms 62
5.7.1 Functions 62
5.7.2 Setting measuring conditions 63
5.7.3 Starting error/alarm measurements 67
5.7.4 Printing measuring results 73

5.8 Sending with Added Errors 74
5.8.1 Setting error addition conditions 74
5.8.2 Adding errors 75

5.9 For the Users of the Existing BERTS 76
5.9.1 Customize subwindow 76
5.9.2 Assigning setting items to the Setup group boxes 78
5.9.3 Assigning measurement items to the Result group box 79
5.9.4 Editing a pattern in the Customize subwindow 80
5.9.5 Starting Error/Alarm measurements in the Customize subwindow 82
5.9.6 Result group box in Customize subwindow 83

5.10 Saving Setting Data in a Data File and Opening a Data File 84
5.10.1 Saving Setting Data in Data Files 84
5.10.2 Opening Data Files 86

CHAPTER 6 APPLICABLE OPERATIONS 89

6.1 Setting Multiple Ports at a Time 90
6.1.1 Tracking function 90
6.1.2 Making settings for Tracking 90

6.2 Making Pattern Settings Common to Units 91

6.3 Setting the Trigger Output 92

6.4 Eye Margin Diagram 93
6.4.1 Functions 93
6.4.2 Setting margin measurement conditions 94
6.4.3 Performing margin measurement 96
6.4.4 Setting diagram measurement conditions 97
6.4.5 Performing dialog Measurement 99
6.4.6 Printing the measurement result 103

6.5 Setup: Utility panel 104

CHAPTER 7 APPLICABLE MEASUREMENT 107

7.1 ECL DFF IC Test 108

CHAPTER 8 PERFORMANCE TEST 111

8.1 Introduction 112

8.2 Test for MU163220A 3.2G Pulse Pattern Generator 113
8.2.1 Trigger output interface 113
8.2.2 Clock output interface 115
8.2.3 Data output interface 120
8.2.4 Burst trigger output interface 125

8.3 Test for MU163240A 3.2G Error Detector 127
8.3.1 Trigger output interface 127
8.3.2 Clock counter 129

CHAPTER 9 SELF-TEST 131
9.1 What is Self-Test? 132
9.2 Connecting Instruments 134
9.3 Basic Operation 137
9.4 Detail Operation 138
9.4.1 Master window 138
9.4.2 System panel 139
9.4.3 Connection panel 140
9.4.4 Setup panel 141
9.4.5 Result panel 142
9.4.6 Details of self-test 143
CHAPTER10 MAINTENANCE·SCRAPPING 155
10.1 Introduction 156
10.2 Daily Maintenance 156
10.2.1 Precautions for Storage 156
10.3 Transportation 157
10.4 Scrapping 157
APPENDIXES 159
Appendix A Sending and Receiving Patterns 160
Appendix B Burst Pattern Generation Principle 163
Appendix C Auto Sync 164
Appendix D Relationships among Amplitude, Offset, and Termination 165
Appendix E Error Addition 166
Appendix F Printer Output Format 167
Appendix G Details on error alarm measurement 170
Appendix H Measurement Extent During Burst Pattern Receiving 175
Appendix I Internal Route Mask 176
Appendix J Internal Threshold 177
Appendix K Pattern Synchronized Output Period 178
Appendix L Entry Table of Performance Test Result 179
Appendix M Initial Settings 181

CHAPTER 1 INTRODUCTION

The MU163220A 3.2G Pulse Pattern Generator is a pulse pattern generator with a range between 10 Mbit/s and 3.2 Gbit/s. The MU163240A 3.2G Error Detector is an error detector with a range between 10 Mbit/s and 3.2 Gbit/s. Both the MU163220A and MU163240A function as a plug-in unit that can be inserted into the slots of the MP1632A Digital Data Analyzer. They are used for evaluation of a variety of digital communication equipment, and modules and devices for digital communication. These products are appropriate for research and development, and also for manufacturing.

Features

- Bit errors can be measured both for continuous signals/burst signals.
- Rich patterns to deal with various kinds of systems
  PRBS (2n-1: n=7 to 31, variable mark ratio), PRGM (8,388,608 bits), zero substitute pattern.
- Measurement items
  Bit error rate, bit error count, error interval count, error-free interval count, error performance (conforming to G821), and clock frequency
- Eye margin measuring function
- Auto search function (PRBS identification, automatic setting of the optimal phase for the pattern and clock)

Targets

- O/E and E/O converter
- Devices such as LSI for communication and ASIC/FPGA

This operation manual consists of the 11 chapters shown in the following table.

Chapter No.	Explanation
Chapter 1 INTRODUCTION	Product overview, organization of the operation manuals, equipment configuration, and specifications
Chapter 2 PRECAUTIONS	Environmental conditions for installation locations and safety measures
Chapter 3 PANELS AND CONNECTIONS	Arrangement of connectors and their connections, and explanation of their functions
Chapter 4 SCREEN CONFIGURATION	Configuration of the screens
Chapter 5 BASIC OPERATIONS	Explanation of basic operations such as interface setting, and error/alarm measurements
Chapter 6 APPLIED OPERATIONS	Explanation of the functions such as eye margin measurements and impedance settings
Chapter 7 CONCRETE MEASUREMENT	Explanation of connection methods for measurements and concrete examples of settings methods
Chapter 8 PERFORMANCE TEST	Explanation of methods for testing performance of the unit
Chapter 9 SELF-TEST	Explanation of the self-test software
Chapter 10 MAINTENANCE·SCRAPPING	Preventive maintenance for safety, daily maintenance, calibration, storage methods, and transportation methods
APPENDIXES	Detailed explanation of each function and initial settings and so on.

The following lists the standard configuration of the MU163220A 3.2G Pulse Pattern Generator.

Item	Type and symbol	Description	Quantity	Remarks
Equipment configuration	MU163220A	3.2G Pulse Pattern Generator	1	
Accessories	W1386AE	MU163220A/40A operation manual	1	
	J0693A	Coaxial cable	1	1 m
	J0696A	Coaxial cable for measurements	2	50 cm
	Z0306A	Wrist strap	1	
Option	01	4 V_{P-P} Data Output		
	02	4 V_{P-P} Clock Output		

The following lists the standard configuration of the MU163240A 3.2G Error Detector.

Item	Type and symbol	Description	Quantity	Remarks
Equipment configuration	MU163240A	3.2G Error Detector	1	
Accessories	W1386AE	MU163220A/40A operation manual	1	Not attached when purchased together with MU163220A
	J0693A	Coaxial cable	1	1 m
	J0696A	Coaxial cable for measurements	2	50 cm

1.4.1 MU163220A 3.2G Pulse Pattern Generator

Table 1-1 lists the specifications of the MU163220A 3.2G Pulse Pattern Generator.

Table 1-1 MU163220ASpecifications (1/2)

Item	Specifications
Operating frequency	10 M to 3.2 GHz (50 MHz to 3.2 GHz when using MP1632A-03 3.2G internal synthesizer)
External clock input	
Amplitude	0.5 to 2.0 Vp-p
Waveform	<0.5 GHz : square wave, ≥0.5 GHz : square or sine wave
Generation pattern	
Pseudo random pattern (PRBS)	
Pattern length	2^N-1(N=7, 9, 11, 15, 20, 23, 31)
Mark ratio	1/2, 1/4, 1/8, 0/8, $\overline{1/2}$, 3/4, 7/8, 8/8
AND bit shift upon mark ratio setting	1 bit/3 bits
Data pattern	
Data length	2 to 8388608 bits
Zero substitute pattern	
Continuos 0 bit length	1 to (pattern length - 1) bits
Pattern length	2^N (N=7, 9, 11, 15)
Error insertion	
Error ratio	10^{-n} (n : 3, 4, 5, 6, 7, 8, 9), single error
External error input	Provided
Data output	
Number of outputs	2 (DATA/$\overline{\text{DATA}}$, independent)
Amplitude	0.5 to 2 Vp-p (10 mV steps) 0.5 to 4 Vp-p (10 mV steps)(Equipped with OPT01)
Offset voltage	V_{OH} : -2 to +2 V (5 mV steps) V_{OH} : -3.5 to +4.25 V (5 mV steps) (Equipped with OPT01) Display: V_{OH}, V_{TH}, V_{OL} selectable
Raise/fail time	≤80 ps (10 to 90% of amplitude) ≤120 ps (10 to 90% of amplitude) (Equipped with OPT01)
Pattern jitter	≤30 psp-p
Waveform distortion	10% or 0.1 V of amplitude, whichever greater
Load impedance	50Ω (with back termination)
DATA/$\overline{\text{DATA}}$ tracking	$\overline{\text{DATA}}$ amplitude and offset voltage can be set save value as DATA.
Cross point adjustment function	Provided
Connector	SMA

Table 1-1 MU163220ASpecifications (2/2)

Item	Specifications
Clock output	
Number of outputs	2 ($\overline{\text{CLOCK}}$/CLOCK independent)
Amplitude	0.5 to 2 Vp-p (10 mV steps) 0.5 to 4 Vp-p (10 mV steps) (Equipped with OPT01)
Offset voltage	V_{OH}: -2 to +2 V (5 mV steps) V_{OH}: -3.5 to +4.25 V (5 mV steps) (Equipped with OPT01) Display: V_{OH}, V_{TH}, V_{OL} selectable
Raise/fall time	≤80 ps (10 to 90% of amplitude) ≤120 ps (10 to 90% of amplitude) (Equipped with OPT01)
Load impedance	50Ω (with back termination)
Clock delay	-1 to +1 ns (2ps steps)
Connector	SMA
External burst trigger input	
Input level	0 V/-1 V
Connector	SMA
Internal Burst signal	
Burst cycle	2 us to 50 ms (1 us steps)
Enable length	1 us to 50 ms (1 us steps)
Burst trigger output	
Output level	0 V/-1 V
Connector	SMA
Sync signal output	
Number of outputs	1 (1/8 clock, variable pattern synchronization output selectable)
Output level	0 V/-1 V
Connector	SMA
Operating temperature	+5 to +45°C
Power	≤200 VA
Dimensions and mass	232 (W)×49 (H)×449 (D) mm, ≤4.5 kg

1.4.2 MU163240A 3.2G Error Detector

Table 1-2 lists the specifications of the MU163240A 3.2G Error Detector.

Table 1-2 MU163240ASpecifications (1/2)

Item	Specifications
Operationg frequency	10 M to 3.2 GHz (50 MHz to 3.2 GHz when using MP1632A-03 3.2G internal synthesizer)
Data input	
Input waveform	NRZ
Input voltage	0.5 to 4 Vp-p
Variable threshold voltage	-4 to +4 V (1 mV steps)
Termination	Connected to GND, -2 V, +3 V via 50Ω
Connector	SMA
Clock input	
Input waveform	Square wave (<0.5 GHz), square wave or sine wave (≥0.5 GHz)
Duty	50%
Input amplitude	0.5 to 4 Vp-p
Variable input delay	-1 to +1 ns (2ps steps)
Polarity inversion	POS/NEG inversion selectable
Termination	Connected to GND, -2 V, +3 V via 50Ω
Connector	SMA
Auto search function	Phase, threshold, PRBS pattern (allowd if the mark ration is between 1/8 anf 7/8)
Receive pattern	
Pseudo random pattern (PRBS)	
Pattern length	2^N-1 (N=7, 9, 11, 15, 20, 23, 31)
Mark ratio	1/2, 1/4, $\overline{1/8}$, 0/8, 1/2, 3/4, 7/8, 8/8
AND bit shift upon mark ratio setting	1 bit/3 bits
Data pattern	
Data length	2 to 8388608 bits
Zero substitute pattern	
Continuos 0 bit length	1 to (pattern length - 1) bits
Pattern length	2^N (N=7, 9, 11, 15)
Sync mode	Normal, frame
Sync threshold	AUTO or 10^{-n} (n: 2, 3, 4, 5, 6, 7, 8)
Error detection mode	Omission, insertion, total
Measurement items	
Error rate	0.0000×10^{-16} to 1.0000×10^{-0}
Number of errors	0 to 9.9999×10^{16}
Error interval (async)	0 to 9999999 (interval : 100 ms, 1 s)
Error free inerval (EFI)	0.0000 to 100.0000%
Clock frequency	0.01 to 3.2 GHz (resolution : 1 Hz, accuracy : 10 ppm±1 kHz)

Table 1-2 MU163240ASpecifications (2/2)

Item	Specifications
Eye margin measurement function	Provided
Errorr performance calculation function	Provided
Measurement channel mask	1 to 8 channels, each channel settable independently
Error output Number of outputs Output level Connector	 1 (1/8 bit rate OR error) 0/-1 V SMA
Sync signal output Number of outputs Output level Connector	 1 (switchable among 1/8 clock, fixed pattern sync, sync gain output) 0/-1 V SMA
Burst trigger input Input level Connector	 0/-1 V SMA
Operating temperature	+5 to +45°C
Power	≤250 VA
Dimensions and mass	232 (W)×54 (H)×449 (D) mm, ≤5 kg

CHAPTER 2 PRECAUTIONS

2.1 Environmental Conditions of Installation Site

MU163220A 3,2G Pulse Pattern Generator and MU163240A 3.2G Error Detector (here after called "these units") operate normally at an ambient temperature of 5°C to 45°C and ambient humidity of 85% or less. These units must be stored in an environment where the temperature is -20°C to 60°C and the humidity does not exceed 85%. Do not use or store these units in a location exposed to:

1. A place where oxidization could occur or a place exposed to strong vibrations.
2. A place exposed to direct sunlight or heavy dust.
3. A place exposed to water splashes or active gases.

CAUTION

Using these units at room temperatures after leaving it in at low temperatures for a long period could cause the internal circuits to short because of condensation. To avoid this, use these units after condensation has been allowed to dry.

WARNING ⚠

1. Users should not replace any plug-in unit by themselves. Anritsu's Service Department carries out replacement work. Contact your nearest Anritsu branch office or distributor if you need to replace a plug-in unit. If you try to replace it by yourself, you may get injured or may receive electric shocks that could cause death

CAUTION ⚠

1. These units has been developed only for use with the MP1632A Digital Data Analyzer. Using these units with them inserted in any equipment other than the MP1632A could result in damage or malfunction. Never use them with equipment other than the MP1632A.
2. When inputting signals, do not apply voltages exceeding the rated values. This could damage the internal circuit.
3. The output must be terminated with a 50-ohm resistor. Never pass current through the output.
4. Before connecting other equipment (including experimental circuits) to the input/output connectors, be sure to establish a ground to prevent static damage.
5. The outer conductor and core wires of a coaxial cable may be charged like a capacitor. Use them after discharging electrons using a metallic object.
6. Do not remove the internal radial cooling panel. If unit performance degradation or trouble occur by using these units with the internal radial cooling panel removed, it may not be eligible for maintenance.

(Blank)

CHAPTER 3 PANELS AND CONNECTIONS

3.1.1 MU163220A panel layout

Fig. 3-1 shows the front view of the MU163220A 3.2G Pulse Pattern Generator and Fig. 3-2 shows its rear view.

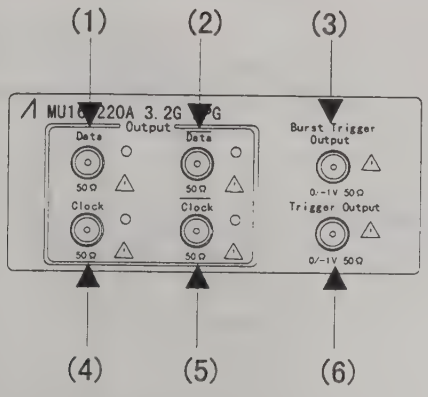


Fig. 3-1 Front panel of MU163220A

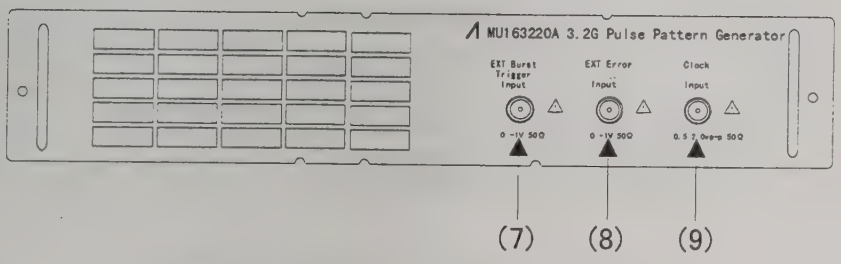


Fig. 3-2 Rear panel of MU163220A

Table 3-1 MU163220A panel

No	Label	Description
(1)	Data Output	Outputs the data signal. (SMA)
(2)	Data Output	Outputs the inverse data signal. (SMA)
(3)	Burst Trigger Output	Outputs the burst trigger signal. (SMA, 50Ω to GND termination)
(4)	Clock Output	Outputs the clock signal. (SMA)
(5)	Clock Output	Outputs the inverse clock signal. (SMA)
(6)	Trigger Output	Outputs the sync signal. (SMA, 50Ω to GND termination)
(7)	EXT Burst Trigger Input	Inputs the external burst trigger signal. (SMA, 50Ω to GND termination)
(8)	EXT Error Input	Inputs the external error addition signal. (SMA, 50Ω to GND termination)
(9)	Clock Input	Inputs the clock signal. (SMA, 50Ω to GND termination)

3.1.2 MU163240A panel layout

Fig. 3-3 shows the front view of the MU163240A 3.2G Error Detector.

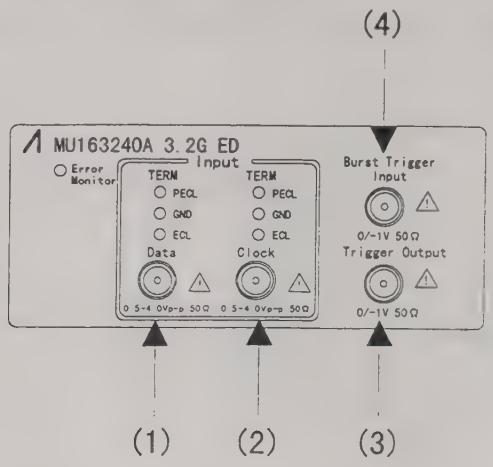


Fig. 3-3 Front panel of MU163240A

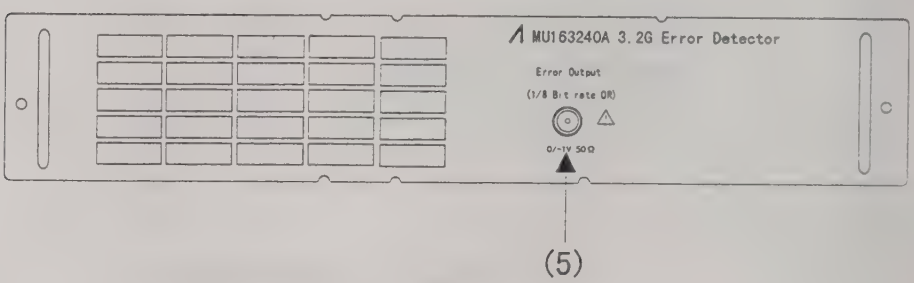


Fig. 3-4 Rear panel of MU163240A

Table 3-2 Explanation of the MU163240A panel

No	Label	Explanation
(1)	Data Input	Inputs the data signal. (SMA)
(2)	Clock Input	Inputs the data signal (SMA)
(3)	Trigger Output	Outputs the sync signal (SMA, 50Ω to GND termination)
(4)	Burst Trigger Input	Inputs the burst trigger signal. (SMA, 50Ω to GND termination)
(5)	Error Output	Outputs the error signal. (SMA, 50Ω to GND termination)

This section describes how to connect the MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector, and other units that are inserted in the MP1632A.

- **Connection to the internal synthesizer option**

Slot1: Option03 3.2G internal synthesizer
Slot3: MU163220A 3.2G Pulse Pattern Generator
Slot4: MU163240A 3.2G Error Detector

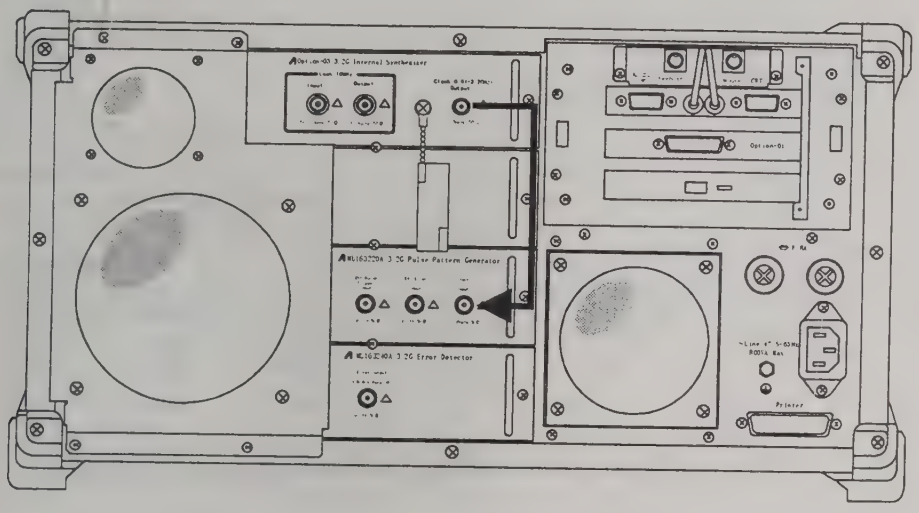


Fig. 3-5 Connection between units

This section describes how to connect the MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector, and external equipment.

- **Connection method (front)**

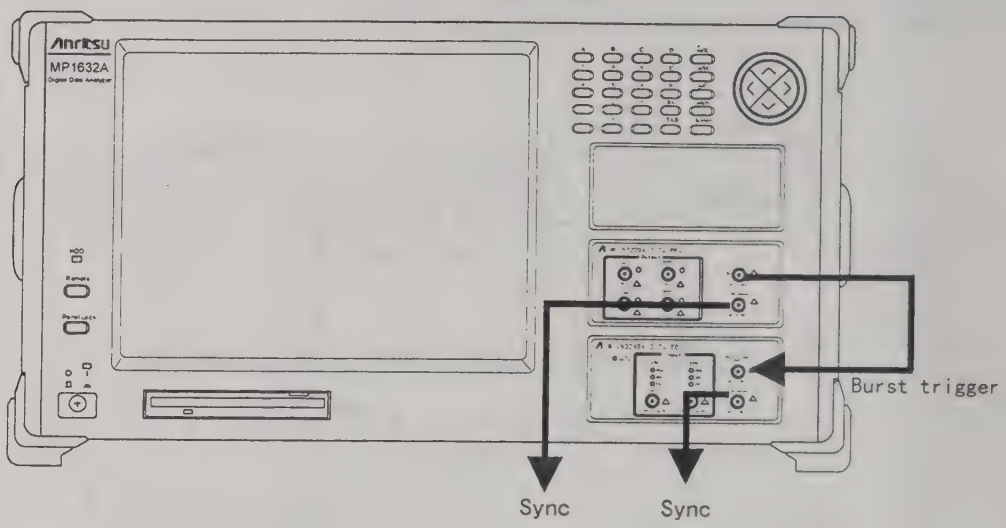


Fig. 3-6 Connecting External Equipment (Front)

- **Connection method (Rear)**

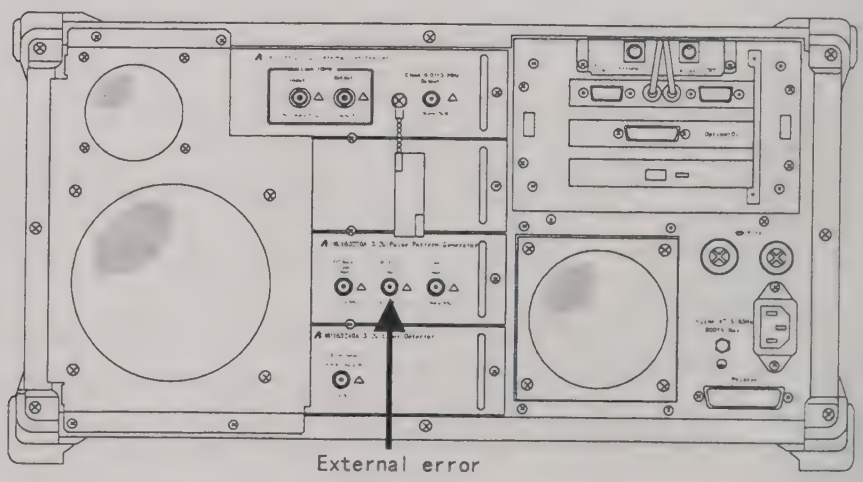


Fig. 3-7 Connecting External Equipment (Rear)

(Blank)

CHAPTER 4 SCREEN CONFIGURATION

The following lists a hierarchical structure of the subwindows and panels when the PPG (Pulse Pattern Generator) and ED (Error Detector) units are inserted in the main unit of MP1632A. For explanations of the screens of the half-tone parts, see the operation manual of the MP1632A Digital Data Analyzer.

Table 4-1 Hierarchical structure of the screens

Subwindow	Panel	Setup item
System	System	Sets the date and time, remote control functions, and system operation mode.
	Option	Displays the configuration of the units installed in the instrument.
Setup	Setup	Sets basic setup items.
	Frequency	Sets the frequency
	Clock I/F	Sets the clock I/O interface.
	Data I/F	Sets the data I/O interface.
	Pattern	Sets transmitted/received patterns. bursts, and synchronization.
	Trigger I/F	Sets trigger/sync I/O signals.
	Utility	Sets the others
Test Menu	Measurement	Sets measurement conditions.
	Error Addition	Sets error addition and delay measurement pattern insertion conditions.
Result	Error/Alarm	Displays error/alarm measurement data and starts or stops measurement.
	Eye Margin	Displays eye margin measurement data and starts or stops measurement.
Customize		Displays setup and error measurement data (item selection and setup by immediate value entry).

CHAPTER 5 BASIC OPERATIONS

5.1.1 Selecting a send/receive pattern

In the MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) and MU163240A 3.2G Error Detector (hereafter called the ED unit), the programmable pattern (PRGM), pseudo-random pattern (PRBS), and zero substitute pattern (Zero-Subst) can be set as a send/receive pattern. This section describes how to set these send/receive patterns. For details of each pattern, see "Appendix A Send/Receive Patterns".

1. Open the 'Setup: Pattern' panel.

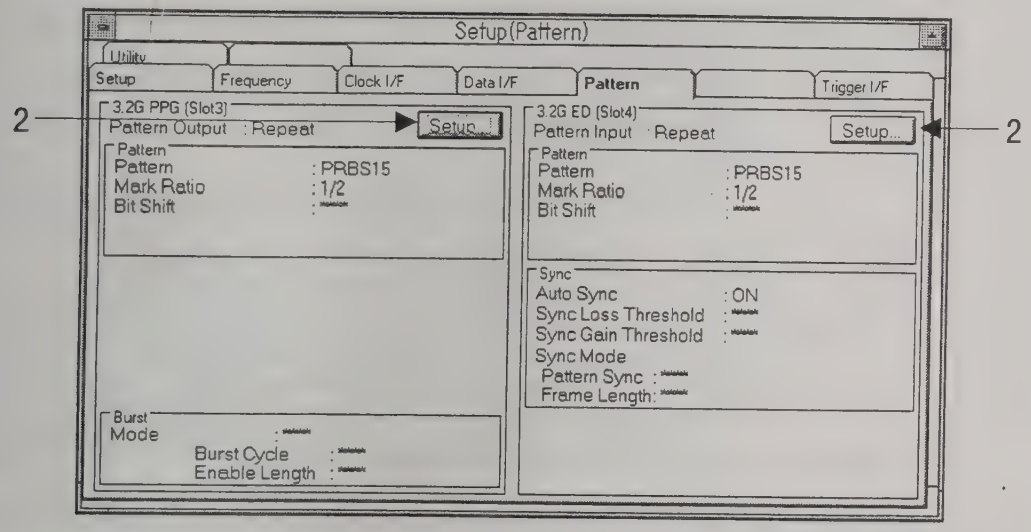


Fig. 5-1 Setup: Pattern panel

2. To set the send pattern, press the Setup button in the PPG group box. To set the receiv pattern, press the Setup button in the ED group box. The Pattern dialog box will be opened Fig. 5-2 shows the Pattern dialog box for the PPG unit, and it for the unit has the same con figuration as far as the settings explained in this section are concerned. We continue ou explanation, presenting the case of the PPG unit.

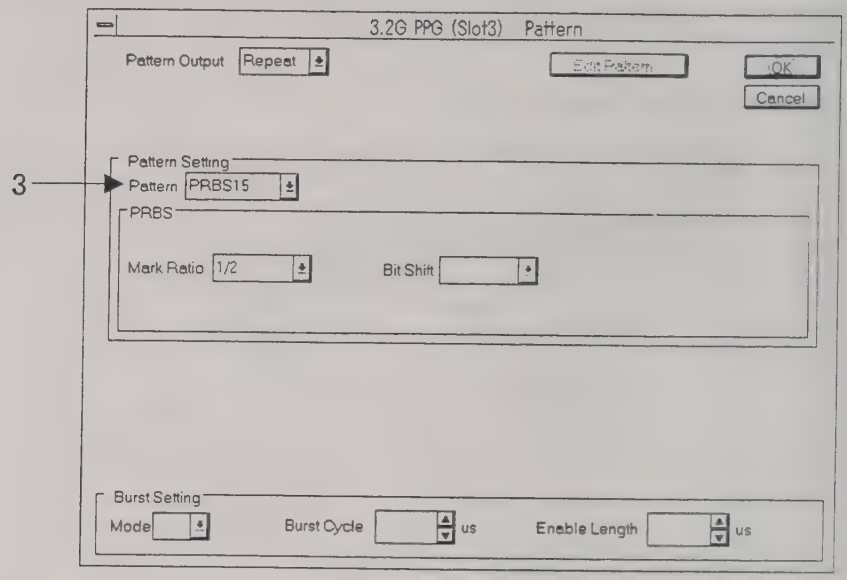


Fig. 5-2 Pattern dialog box

3. See the setting method below according to the pattern you will use.

How to set the PRGM pattern	See "5.1.2 Setting the PRGM pattern".
How to set the PRBS pattern	See "5.1.3 Setting the PRBS pattern".
How to set the Zero-Subst pattern	See "5.1.4 Setting the zero substitute pattern".

5.1.2 Setting the PRGM pattern

This section describes how to set the PRGM pattern as the send/receive pattern.

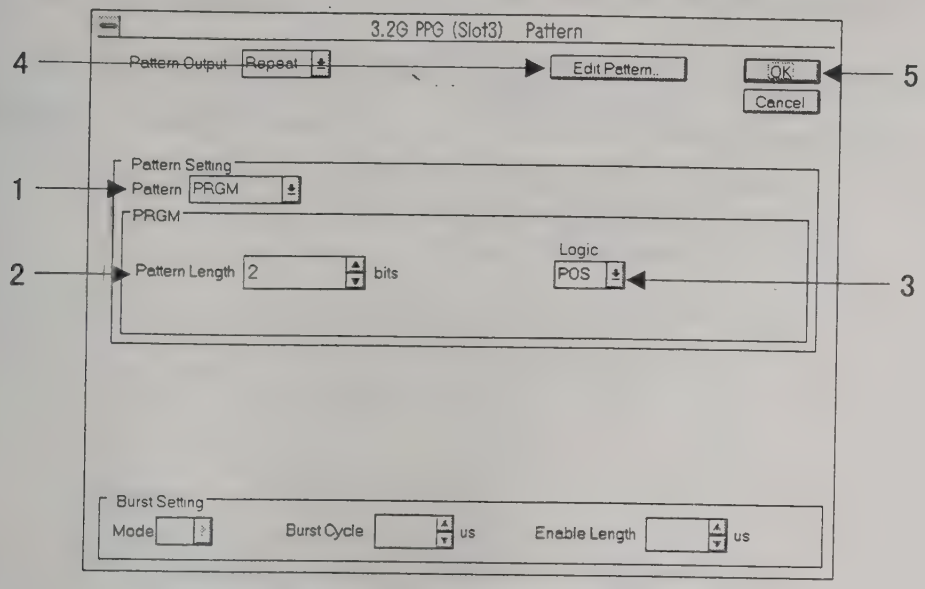


Fig. 5-3 Pattern dialog box (when PRGM is set)

1. Select PRGM from the Pattern drop-down list box of the Pattern Setting group box.

2. Set the pattern length by entering it in the Pattern Length text box in the PRGM group box. The pattern length ranges from 2 to 8,388,608 bits. The following lists the correspondence between the pattern length and bit resolution.

2 to 131072 bits	resolution of 1 bit
131072 to 262144 bits	resolution of 2 bits
262144 to 524288 bits	resolution of 4 bits
524288 to 1048576 bits	resolution of 8 bits
1048576 to 2097152 bits	resolution of 16 bits
2097152 to 4194304 bits	resolution of 32 bits
4194304 to 8388608 bits	resolution of 64 bits

3. Set the pattern logic by selecting from the Logic drop-down list box in the PRGM group box.

4. To edit the PRGM pattern, press the Edit Pattern button. The Pattern Editor dialog box will be opened. For operations of the Pattern Editor dialog box, see "5.2 Creating/Editing a Pattern".

5. Now the setting is completed. To enable the change, press the OK button.

5.1.3 Setting the PRBS pattern

This section describes how to set the PRBS pattern as the send/receive pattern.

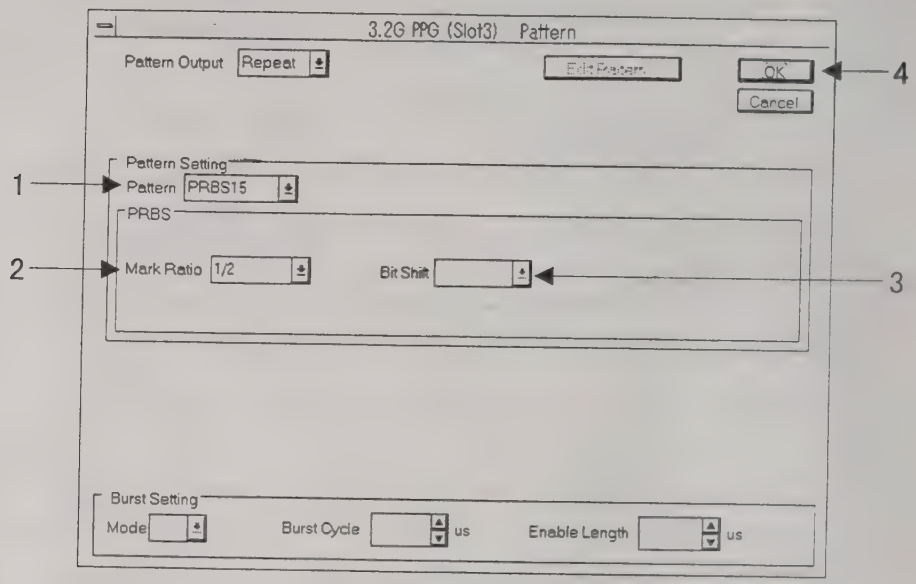


Fig. 5-4 Pattern dialog box (when PRBS is set)

1. Select from the Pattern drop-down list box in the Pattern Setting group box.

PRBS7	Sets the pattern to PRBS of 2^7-1.
PRBS9	Sets the pattern to PRBS of 2^9-1.
PRBS11	Sets the pattern to PRBS of 2^{11}-1.
PRBS15	Sets the pattern to PRBS of 2^{15}-1.
PRBS20	Sets the pattern to PRBS of 2^{20}-1.
PRBS23	Sets the pattern to PRBS of 2^{23}-1.
PRBS31	Sets the pattern to PRBS of 2^{31}-1.

2. Set the mark ratio by selecting from the Mark Ratio drop-down list box in the PRBS group box.

1/2	Sets the mark ratio to 1/2.
1/4	Sets the mark ratio to 1/4.
1/8	Sets the mark ratio to 1/8.
0/8	Sets all to the 0 pattern
1/2INVT	Sets the mark ratio to 1/2.
3/4	Sets the mark ratio to 3/4.
7/8	Sets the mark ratio to 7/8.
8/8	Sets all to the 1 pattern

3. Set the bit shift by selecting from the Bit Shift drop-down list box in the PRBS group box.

1 bit Shift	Sets to the 1-bit shift
3 bit Shift	Sets to the 3-bit shift

Note

The bit shift cannot be set if the mark ratio has been set to 1/2, 1/2INVT, 0/8, or 8/8 in procedure 2.

4. Now the setting is completed. To enable the change, press the OK button.

5.1.4 Setting the zero substitute pattern

This section describes how to set the zero substitute pattern as the send/receive pattern.

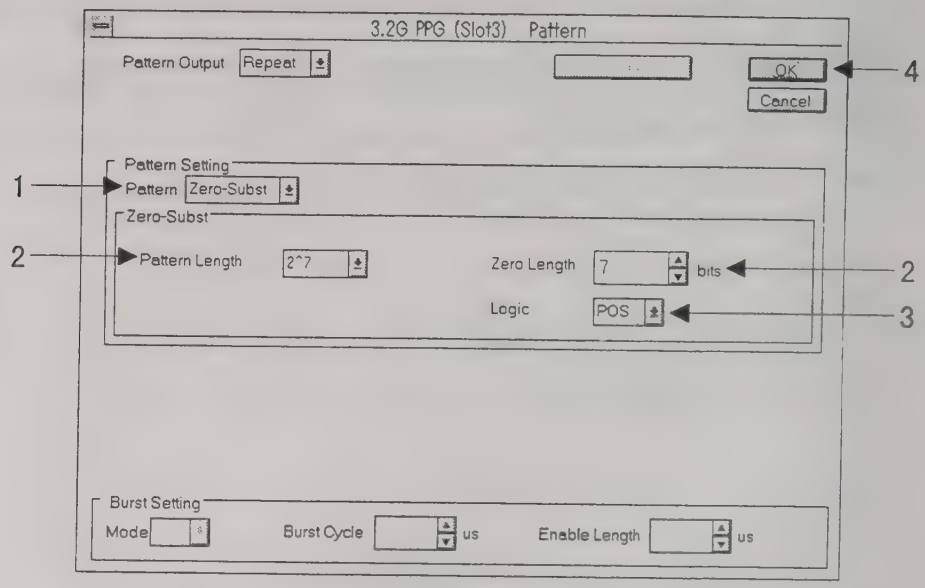


Fig. 5-5 Pattern dialog box (when Zero-Subst is set)

1. Select Zero-Subst from the Pattern drop-down list box in the Pattern Setting group box.

2. Set the pattern length and zero bit insertion length by selecting the pattern length from th Pattern Length drop-down list box in the Zero-Subst group box, and setting the zero bit in sertion length in the Zero Length text box.

   The following lists the relations between the pattern length and the Min./Max. values of th zero bit insertion length.

Pattern Length	Min. value of the Zero bit	Max. value of the Zero bit
2^7	7	127
2^9	9	511
2^11	11	2,047
2^15	15	32,767

3. Set the pattern logic by selecting from the Logic drop-down list box in the Zero-Subst grou box.

4. Now the setting is completed. To enable the change, press the OK button.

5.2.1 Selecting the display mode

MU163220A 3.2G Pulse Pattern Generator (here after called the PPG unit) and MU163240A 3.2G Error Detector (hereafter called the ED unit) have a Pattern Editor dialog box which allows to create/edit a PRGM pattern. In the Pattern Editor dialog box, you can create/edit PRGM patterns.

This section describes how to create/edit a PRGM pattern using the Pattern Editor dialog box. You can open the Pattern Editor dialog box by pressing the Edit Pattern button on the Pattern dialog box opened from the 'Setup: Pattern' panel.

Note

1. If the system operation mode allows measurements during power failure, you cannot open the Pattern Editor dialog box. You should either edit in a Customize subwindow or change the system operation mode.
2. For details on operations of the Customize subwindow, see "5.9 For Users of the Existing BERTS"
3. For details on how to change the system operation mode, see "6.4 Setting System Operations" of the MP1632A Digital Data Analyzer operation manual.
4. Depending on the color setting of Windows, the cursor on the editor may become hard to see. You can set the color of Windows using Control Panel in the Main group of Program Manager. If you want to know how to use the Control Panel, see the online help of it that is attached to Control Panel.

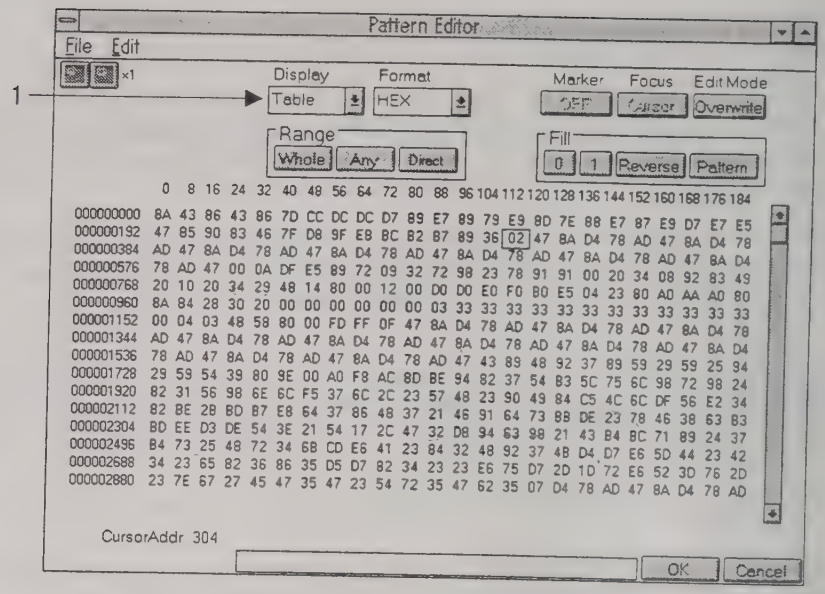


Fig. 5-6 Pattern Editor dialog box

1. Set the display mode of the Pattern Editor by selecting from the Display drop-down list bo of the Pattern Editor dialog box.

Time	Displays/Edits a pattern in one horizontal line, taking the time base in the cross direction. You can display/edit it as images of waveform, or binary numbers.
Table	Displays/Edits a pattern as images of memory dumps. You can display/edit it as binary numbers or hexadecimal numbers.

2. See the following editing method according to the display mode you selected in the Displa drop-down list box.

For the editing method in Time mode, see "5.2.2 How to edit in Time display mode".
For the editing method in Table mode, see "5.2.3 How to edit in Table display mode".

5.2.2 How to edit in Time display mode

This section describes how to create/edit a pattern in "Time" display mode.

1. Select the display format from the Format drop-down list box of the Pattern Editor dialog box.

Wave	Displays/Edits as images of waveform. The display can be scaled using the Zoom Up and Zoom Down buttons.
BIN	Displays/Edits in binary numbers.

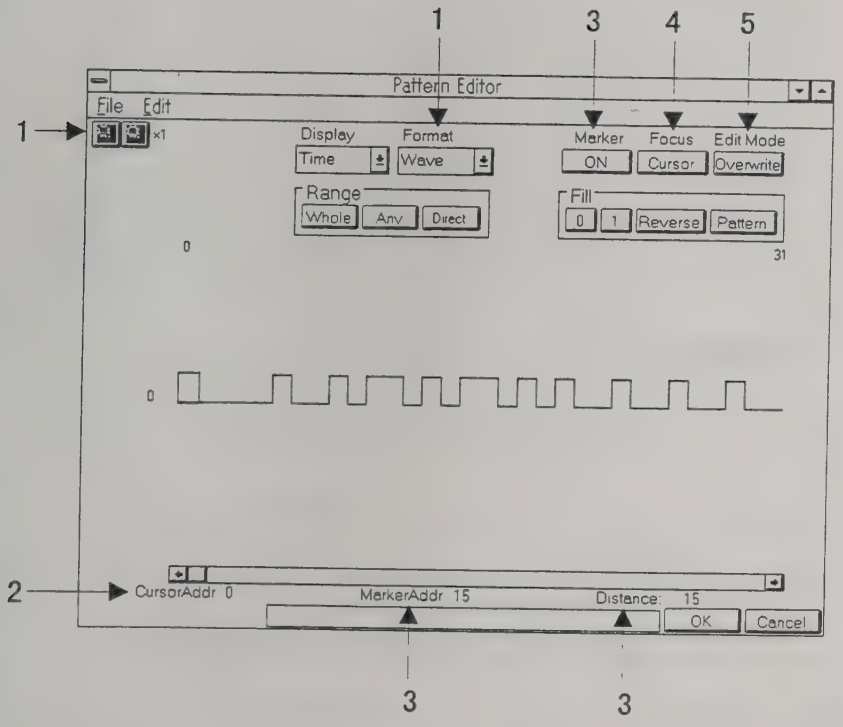


Fig. 5-7 Pattern Editor dialog box (Time display mode)

2. The cursor address is displayed here.

3. Set the marker display by pressing the Marker button, which toggles between the display and non-display of the marker. The marker address is displayed at the Marker Addr, and the distance between the cursor and marker is displayed at the Distance.

4. Select the target for operation by pressing the Focus button, which toggles between the cursor and marker. You can move the cursor or marker selected as the target for operation using the click, arrow keys, or rotary encoder.

5. Set the edit mode by pressing the Edit Mode button, which toggles between the insertion mode and overwrite mode.

6. Use the keys 0 and 1 for pattern input. If you double-click on the touch panel, the curs moves to the position where you double-clicked and the bit at the position is inverted.

7. For other functions, see "5.2.4 Selecting the areas" or subsequent sections.

5.2.3 How to edit in Table display mode

This section describes how to create/edit a pattern in "Table" display mode.

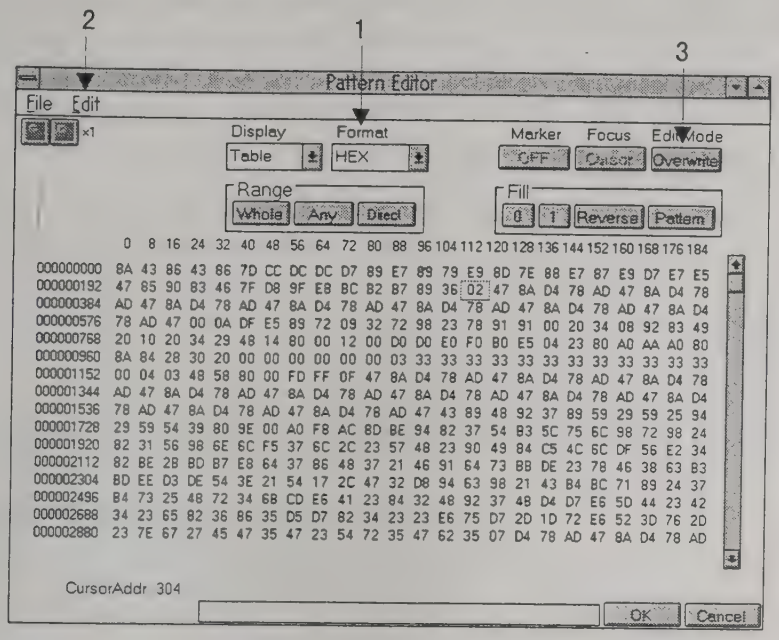


Fig. 5-8 Pattern Editor dialog box (Table display mode)

1. Select the display format from the Format drop-down list box of the Pattern Editor dialog box.

BIN	Displays/Edits in binary numbers.
HEX	Displays/Edits in hexadecimal numbers.

2. You can change the amount of data displayed in one line. Open the Line dialog box by selecting Line from the Edit pull down menu. Enter the desired number of bytes in the spin box and then press the OK button.

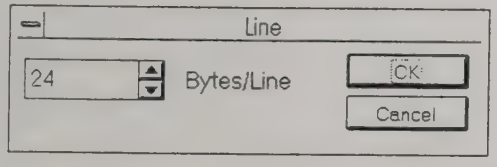


Fig. 5-9 Line dialog box

3. Set the edit mode by pressing the Edit Mode button, which toggles between the insertion mode and overwrite mode.

4. For pattern input, use the keys 0 and 1 when the binary number display is used, and use t keys 0 to 9 and A to F when the hexadecimal number display is used.

5. If you double-click on the touch panel when the binary number display is used, the curs moves to the position where you double-clicked and the bit at the position is inverted.

6. For other functions, see "5.2.4 Selecting the area" or subsequent sections.

5.2.4 Selecting the areas

In the Pattern Editor dialog box, you can specify a selected area consisting of multiple bits, and perform editing work for this area collectively. The selected areas can be used when performing substitute input using the Fill group box, using Cut, Copy, and Paste of the edit commands, and saving PRGM patterns.
This section describes how to set the selected areas using the Range group box.

To set the selected area, use each button in the Range group box. The following lists the functions of each button.

Button	Function
Whole	Specifies the whole pattern as the selected area.
Any	Specifies any area as a selected area by specifying an address. The address is specified by input in the Input Range dialog box.
Direct	Specifies any area as a selected area by specifying an address. The address is specified using the cursor.

■ We explain how to specify a selected area using the Any button.

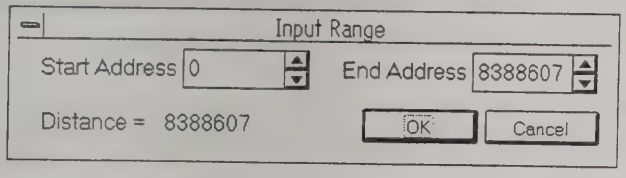


Fig. 5-10 Input Range dialog box

1. Enter the start address of the selected are in the Start Address spin box.
2. Enter the end address of the selected are in the End Address spin box.
3. If you press the OK button, the specified area becomes the selected area and is displayed in reverse mode.

■ We explain how to specify a selected area using the Direct button.

1. Press the Direct button. The button is held pressed and the Direct mode is set. You ca not enter/edit patterns in Direct mode.

2. Specify the starting point of the selected area. Double-click the starting point of the lected area or move the cursor to the point and then press Enter.

3. Specify the ending point of the selected area. Display the ending point of the selected ar on the screen by using Jump of the Edit pull down menu or other ways. Double-click t ending point of the selected area or move the cursor to the point and then press Enter.

4. Now the selected area is set.

■ You can also specify an area in the following ways.

1. You can specify a selected area by dragging.

2. You can specify a selected area by clicking on the starting point of the selected area, and the clicking on the ending point while pressing the Shift key.

3. You can specify a selected area by moving the cursor to the starting point, and then specif ing the ending point by the cursor key while pressing the Shift key.

4. You can expand the area by clicking or moving the cursor while pressing the Shift key in state in which the area has been established.

5.2.5 Pattern input

This section describes how to enter a pattern using the buttons in the Fill group box. The following lists the functions of each button in the Fill group box.

Button	Function
0	Replaces the bit at the cursor position with 0.
1	Replaces the bit at the cursor position with 1.
Reverse	Inverts the bit at the cursor position.
Pattern	Enters repetition of any pattern.

- We explain about pattern input using the Pattern button.

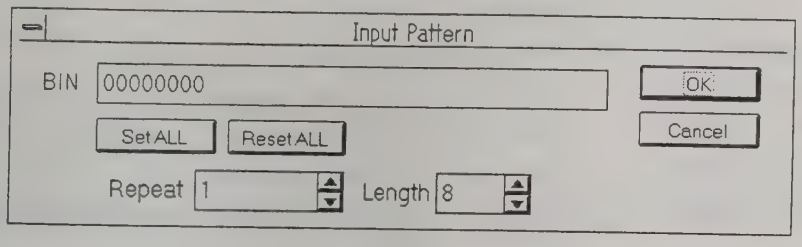


Fig. 5-11 Input Pattern dialog box

1. Enter the number of bits to be entered in the Length spin box.
2. Enter the number of times of repetition of the specified pattern in the Repeat spin box.
3. If you press the Set All button, all bits are set to 1.
4. If you press the Reset All button, all bits are set to 0.
5. Enter the pattern in the BIN or HEX text box.
6. If you press the OK button, the pattern is entered at the cursor position.

Note

If you open the Input Pattern dialog box when a selected area has been specified, the selected area will be replaced by repetition of the specified pattern regardless of the number of times of repetition specified in the Repeat spin box.

5.2.6 Edit commands

This section describes the commands that can be selected from the Edit pull-down menu in th Pattern Editor dialog box.

Table 5-1 Edit commands of Pattern Editor

Command	Function
Undo	Cancel the preceding operation.
Cut	Remove the data in the selection area or at the cursor and stores it in the buffer.
Copy	Copies the data in the selection area or at the cursor to the buffer.
Paste	If a selection area has been set, substitute it with the data stored in the buffer. If not set, the data stored in the buffer is added at the cursor position.
Jump-Head	Jump to the beginning of the pattern.
Jump-Tail	Jump to the end of the pattern.
Jump-Marker	If the marker is ON, jump the marker to the center of the screen.
Jump-Address	Jump to the specified address.
Jump-Pattern	Search for the specified pattern, and jump to the head of the first searched pattern.
Jump-Next	Search for the next pattern under the same condition as that of the Jump-Pattern command executed directly before.
Line	Specify how many bytes display per line.

■ Specifying the address at the jump destination

1. Selecting Jump-Address will open the Input Address dialog box.

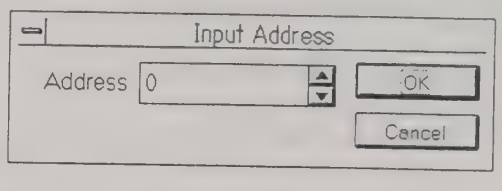


Fig. 5-12 Input Address dialog box

2. Enter the jump destination address in the spin box in the Input Address dialog box, then press the OK button.

■ Specifying the pattern to search

1. Selecting Jump-Pattern will open the Input Pattern dialog box.

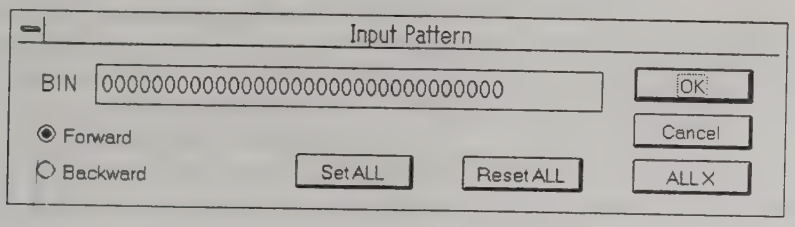


Fig. 5-13 Input Pattern dialog box

2. Pressing the SetALL button will set all bits to 1s.

3. Pressing the ResetALL button will set all bits to 0s.

4. Enter a pattern in the BIN or HEX text box. To enter a Don't Care bit, press the 0 key with the Shift key pressed down. Pattern length you can reference is variable from 1 bit to 32 bits.

5. Select the search direction by pressing the Forward or Backward option button.

6. Press the OK button.

5.2.7 Panel key and keyboard operations

This section lists the operations that can be performed using the keys on the Pattern Editor dialog box and external keyboard.

Table 5-2 Panel key operations

Arrow keys	Move the cursor.
Shift + arrow keys	Perform the same operation as area specification performed by dragging the mouse.
Enter	Performs the same operation as double clicking
Numeric characters and A to F	Input a pattern
Shift+0	Specifies Don't Care.
Back Space	Deletes the data to the left of the cursor.

Table 5-3 Keyboard key operations

Arrow keys	Move the cursor.
Shift + arrow keys	Performs the same operation as area specification performed by dragging the mouse.
Home	Moves the cursor to the left end of the screen.
Ctrl + Home	Jumps the cursor to the head of the pattern.
End	Moves the cursor to the right end of the screen.
Ctrl + End	Jumps to the end of the pattern.
Page Up	Scrolls the screen one page rightward or downward.
Page Down	Scrolls the screen one page leftward or upward.
Enter	Performs the same operation as double clicking
Numeric characters and A to F	Input a pattern.
Shift + 0 or X	Specifies Don't Care.
Delete	Removes the data in the selection area or at the cursor and stores it in the buffer.
Back Space	Deletes the data to the left of the cursor.
Insert	Switches between insert and overwrite modes.

5.2.8 PRGM Saving a PRGM pattern

There are two methods available to save patterns edited in the Pattern Editor dialog box in a file. One method is to save patterns as a pattern setting data file. The other method is to save patterns as a pattern clip file. The pattern setting data file contains the setting state concerning the pattern as well as bit strings of the pattern. The pattern clip file consists simply of bit strings of the pattern.
This section describes how to save a created PRGM pattern as a pattern clip file. For the pattern setting data file, see "5.10 Saving Settings in a Data File/Opening a Data File".

1. Select "Save" from the File pull down menu of the Pattern Editor dialog box. The Save dialog box will be opened.

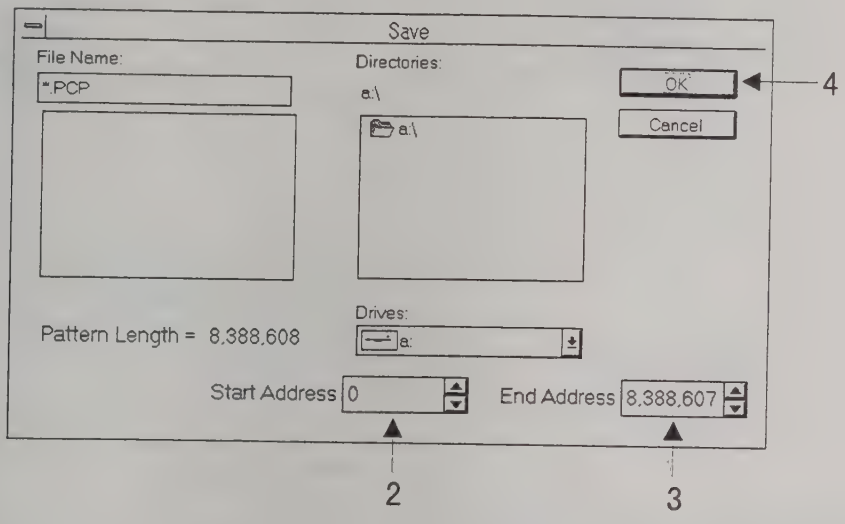


Fig. 5-14 Save dialog box

2. Enter the start address in the Start Address spin box.

3. Enter the end address in the End Address spin box.

4. Enter the drive, directory, and file names and then press the OK button. When you enter a file name, do not change the extension.

Note

If you select an area and then open the Save dialog box, the selected area will be set in the Start Address spin box and End Address spin box.

5.2.9 Opening the PRGM pattern

A pattern saved as a pattern clip file can be read from the file and then inserted into patter being edited, or they can be overwritten. This section describes how to read the pattern clip fil

1. Patterns that have been read in the pattern clip file are entered at the cursor positio Move the cursor to any position you want for pattern input.

2. Select "Open" from the File pull down menu of the Pattern Editor dialog box. The Ope dialog box will be opened.

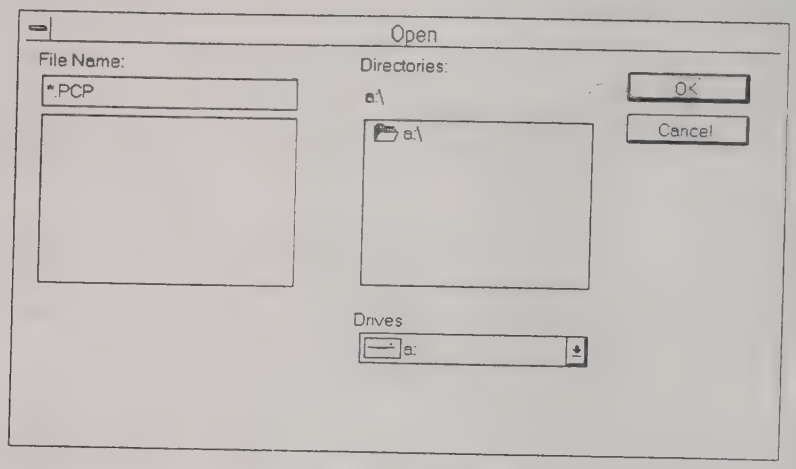


Fig. 5-15 Open dialog box

3. Enter the drive, directory, and file names and then press the OK button. The pattern will be entered at the cursor position.

5.2.10 Printing the pattern

This section describes how to print the created pattern. There are two printing methods available. One method is to print from the Pattern Editor dialog box. The other method is to print from the parent window. We show printing examples in "Appendix F Printer Output Format".

Printing from the Pattern Editor

1. Select "Print" from the File pull down menu of the Pattern Editor dialog box. The Print dialog box will be opened.

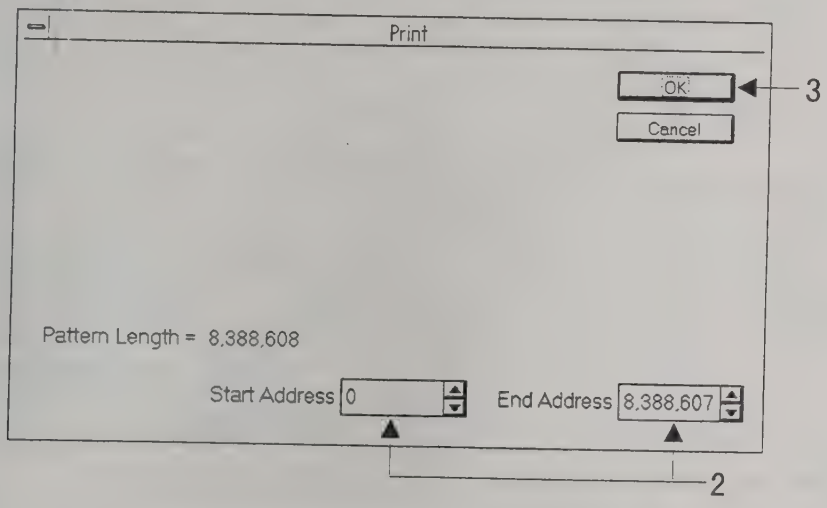


Fig. 5-16 Print dialog box

2. Specify the range of the pattern to be printed in the Start Address and End Address text boxes.

3. If you press the OK button, printing starts.

Note

The output format is the same as the pattern display format of the Pattern Editor dialog box when the Print dialog box is opened. However, the output format is the "BIN" instead of the "Wave" in time display mode.

Printing from the parent window

1. Select Print from the File pull down menu of the parent window. The Print dialog box wi be opened.

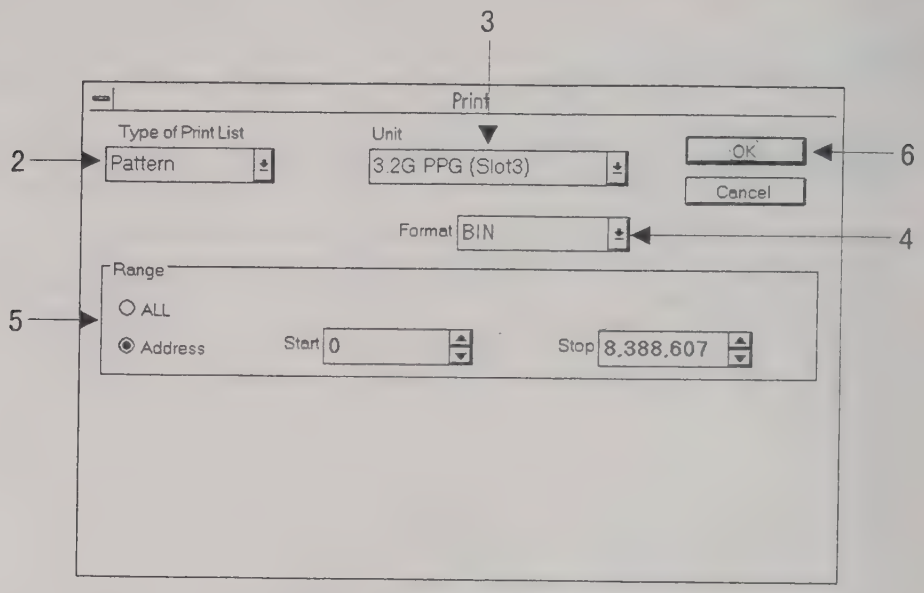


Fig. 5-17 Print dialog box

2. Select Pattern from the Type of Print List drop-down list box.

3. Select the unit which owns the desired pattern from the Unit drop-down list box.

4. Specify the pattern format to be printed in the Format drop-down list box.

5. If you want to print the whole range of the pattern, check ALL. If you want to print any arbitrary range, check Address and then specify the range in the Start Address and End Address text boxes.

6. If you press the OK button, printing starts.

5.3.1 Sending the burst pattern

The MU163220A 3.2G Pulse Pattern Generator (here after called the PPG unit) can send the burst pattern.
The burst trigger signals for burst control can be selected from internal signals and external signals. If you select internal signals, you must set the burst cycle and enable length. For more details, see "Appendix B Burst Patterns Generation Principle".
The burst trigger signals are output from the Burst Trigger Output on the front panel of the PPG unit.
This section describes the procedures for sending the burst pattern.

1. Open the 'Setup: Pattern' panel.

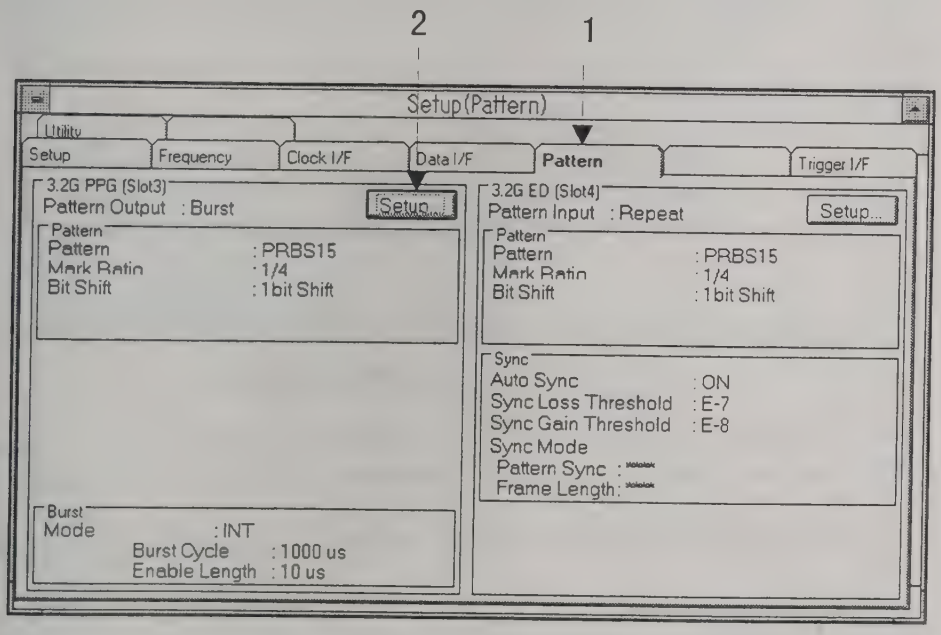


Fig. 5-18 Setup: Pattern panel

2. Press the Setup button in the group box on the PPG unit side. The Pattern dialog box w be opened.

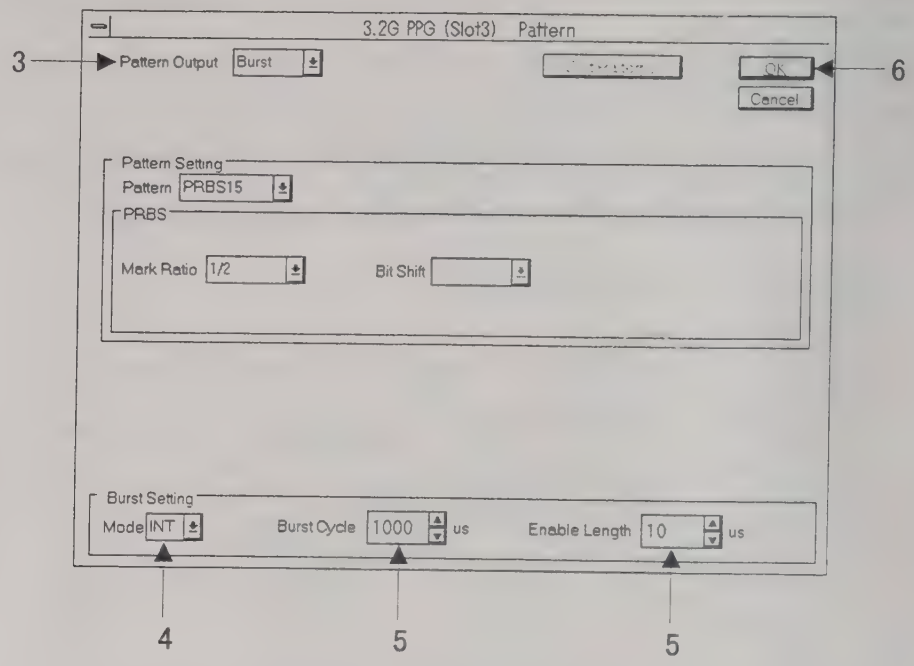


Fig. 5-19 Pattern dialog box

3. Set the Pattern Output mode to burst by selecting "Burst" from the Pattern Output drop down list box. Setting items in the Burst Setting group box will be enabled.

4. Specify the source of the burst signals. Specify either "INT" for internal, or "EXT" for exter nal.

Note

When external signal is used as the burst source, high input shows valid period and low does invalid period. Its pulse width must exceed (64 / fundamental frequency).

5. Enter the burst cycle and enable length in the Burst Cycle spin box and Enable Length spi box respectively. The following lists the ranges that can be set for each item.

Item	Range that can be set
Burst cycle	2 to 50000 us
Enable length	1 to 49999 us

Note

The enable length must be less than the burst cycle.

6. Now the setting is completed. To enable the change, press the OK button.

5.3.2 Receiving the burst pattern

The MU163240A 3.2G Error Detector (hereafter called the ED unit) can measure the burst pattern. This section describes the procedures for receiving the burst pattern.

1. Open the 'Setup: Pattern' panel.

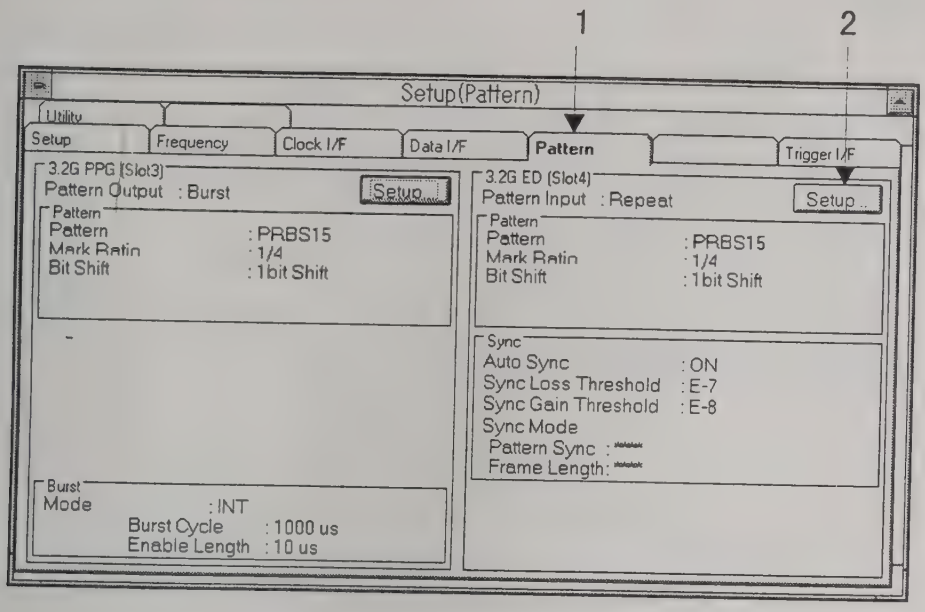


Fig. 5-20 Setup: Pattern panel

2. Press the Setup button in the group box on the ED unit side. The Pattern dialog box will be opened.

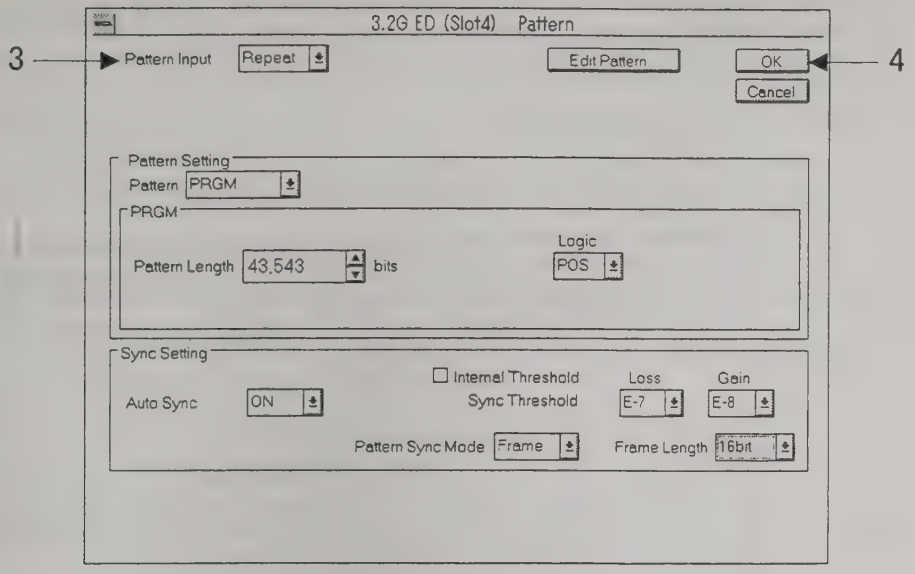


Fig. 5-21 Pattern dialog box

3. Select "Burst" from the Pattern Output drop-down list box.

4. Now the setting is completed. To enable the change, press the OK button.

Note

The ED measurement burst pattern only when the burst trigger signal is high. The period that the burst trigger signal is low, the ED stops measuring. The specifications of the burst trigger signal is described bellow.

Amplitude	1 Vp-p ±20%
Offset	0 ±0.2 V (V_{IH})

5.4.1 Setting the Data output interface

This section describes the procedures for setting the Data output interface of the MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit).

1. Open the 'Setup: Data I/F' panel.

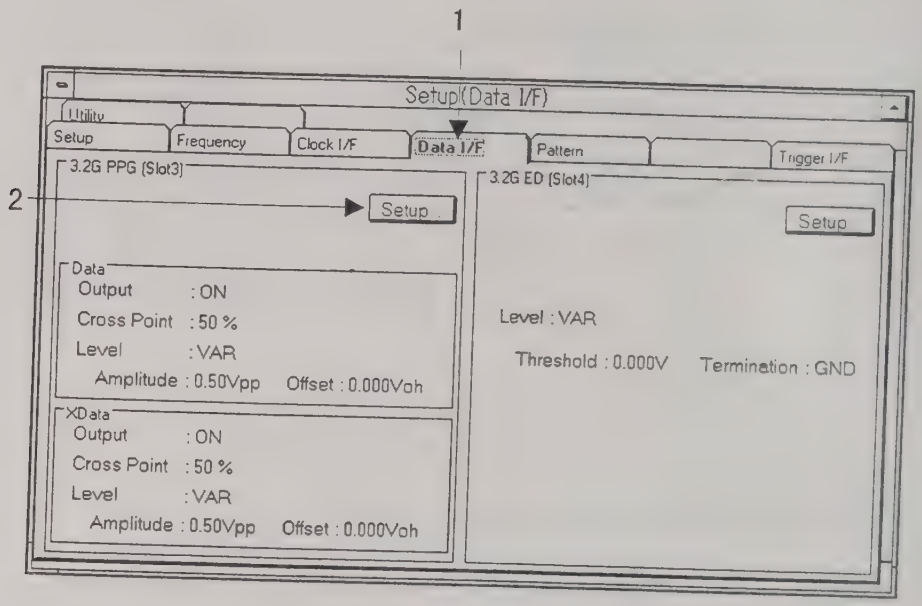


Fig. 5-22 Setup: Data I/F panel

2. Press the Setup button in the PPG group box. The Data Interface dialog box will be opened.

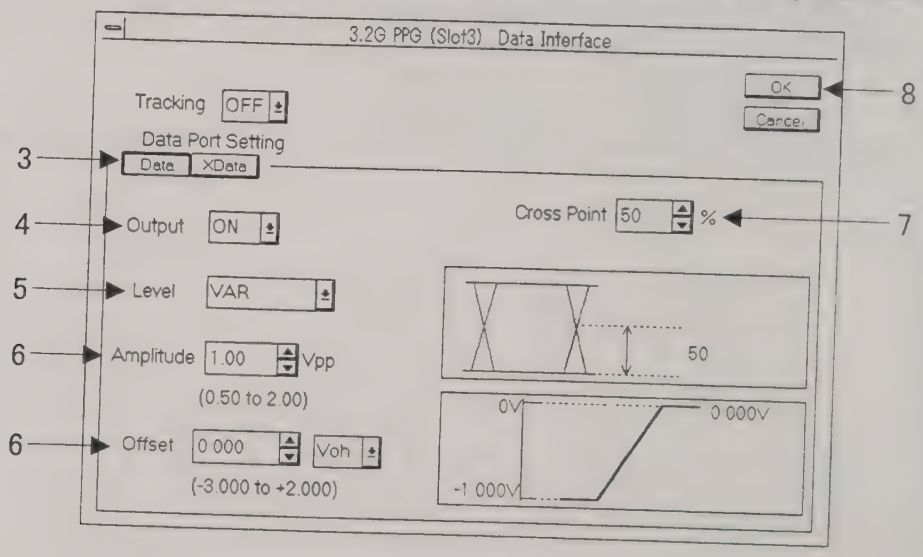


Fig. 5-23 Data Interface dialog box

Note

If MU163220A mounts OPT01 , the Amplitude range and Offset range are as following.

	V_{OH}	V_{TH}	V_{OL}
Amplitude	(0.50 to 4.00)	(0.50 to 4.00)	(0.50 to 4.00)
Offset	(-3.500 to 4.250)	(-3.750 to 4.000)	(-4.000 to 3.750)

3. Select the data port to be set.

4. Set ON/OFF of the Data output by selecting from the Output drop-down list box.

Note

It is high impedance while the Output is OFF

5. Set the level by selecting from the Level drop-down list box. If you select "ECL" or "TTL", you cannot carry out the setting in Procedure 6.

VAR	Sets to any arbitrary level.
ECL	Sets to the ECL level.
TTL	Sets to the TTL level. (Equipped with OPT01)

Note

Selection of ECL is not allowed if 50Ω is selected for Data I/F on the 'Setup: Utility' panel.

6. Set the amplitude and offset. Select the potential as a reference for offset from the drop-down list box on the right side of the Offset text box. The values you can select are listed below. The range of the offset that can be set depends on how the amplitude is set. For more details, see "Appendix D Relationships among Amplitude, Offset, and Termination".

Voh	Sets the offset value as a High level.
Vth	Sets the offset value as a center value between the High level and Low level
Vol	Sets the offset value as a Low level.

7. Set the cross point. The range that can be set is between 25% and 75%.

8. Now the setting is completed. To enable the change, press the OK button.

CAUTION ⚠

Measured systems may be destroyed depending on the settings. A message is displayed for confirmation. Start measurements after checking the settings you specified and measuring targets adequately.

5.4.2 Setting the Clock output interface

This section describes the procedures for setting the Clock output interface of the MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit).

1. Open the 'Setup: Clock I/F' panel.

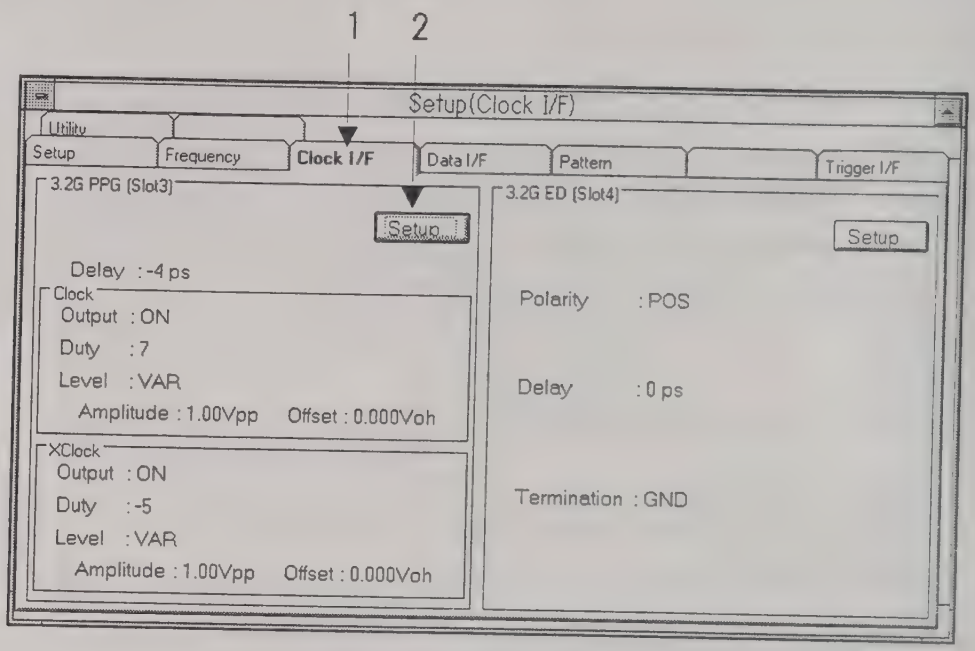


Fig. 5-24 Setup Clock I/F panel

2. Press the Setup button in the PPG group box. The Clock Interface dialog box will be opened.

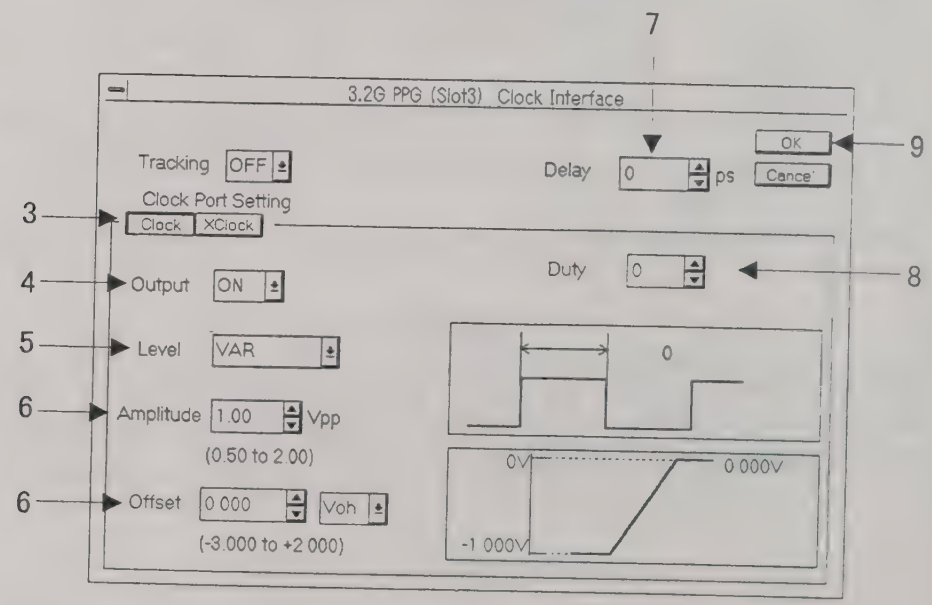


Fig. 5-25 Clock Interface dialog box

Note

If MU163220A mounts OPT02 , the Amplitude range and Offset range are as following.

	V_{OH}	V_{TH}	V_{OL}
Amplitude	(0.50 to 4.00)	(0.50 to 4.00)	(0.50 to 4.00)
Offset	(-3.500 to 4.250)	(-3.750 to 4.000)	(-4.000 to 3.750)

3. Select the port to be set.

4. Set On/Off of the clock output by selecting from the Output drop-down list box.

Note

It is high impedance while the Output is OFF

5. Set the level by selecting from the Level drop-down list box. If you select "ECL" or "TTL", you cannot carry out the setting in Procedure 6.

VAR	Sets to any arbitrary level.
ECL	Sets to the ECL level.
TTL	Sets to the TTL level. (Equipped with OPT02)

Note

Selection of "ECL" is not allowed if 50Ω is selected for Clock I/F on the 'Setup: Utility' panel.

6. Set the amplitude and offset. Select the potential as a reference for offset from the drop-down list box on the right side of the Offset text box. The range of the offset that can be set depends on how the amplitude is set. For more details, see "Appendix D Relationships among the Amplitude, Offset, and Termination".

Voh	Sets the offset value as a High level.
Vth	Sets the offset value as a center value between the High level and Low level.
Vol	Sets the offset value as a Low level.

7. Set the delay by entering a value in the Delay spin box. The setting range that can be set is between -1000 ps and +1000 ps , and the resolution is 2 ps.

8. Set the duty by entering a value in the Duty spin box. The setting range is 50 steps between -25 and +25.

9. Now the setting is completed. To enable the change, press the OK button.

CAUTION ⚠

Measured systems may be destroyed depending on the settings. A message is displayed for confirmation. Start measurements after checking the settings you specified and measuring targets adequately.

5.4.3 Setting the Data input interface

This section describes the procedure for setting the Data input interface of the MU163240A 3.2G Error Detector (hereafter called the ED unit).

1. Open the 'Setup: Data I/F' panel.

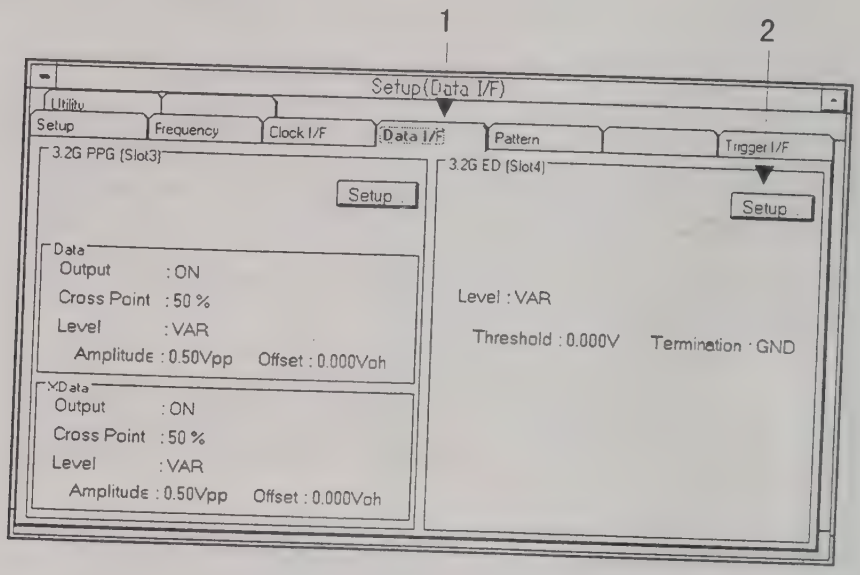


Fig. 5-26 Setup: Data I/F panel

2. Press the Setup button in the ED group box. The Data Interface dialog box will be opened.

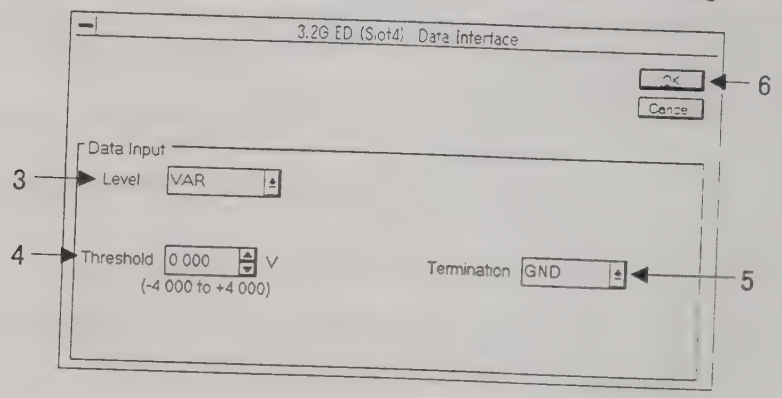


Fig. 5-27 Data Interface dialog box

3. Set the level by selecting from the Level drop-down list box. If you select ECL, PECL or TTL, you cannot carry out the settings in Procedures 4 and 5.

VAR	Sets to any arbitrary level.
ECL	Sets to the ECL level.
PECL	Sets to the PECL level.
TTL	Sets to the TTL level.

4. Set Threshold by entering a value in the Threshold spin box. The range that can be set is between -4,000 V and +4,000 V.

5. Set the termination condition of the data input by selecting from the Termination drop-down list box.

GND	Ground termination
-2 V	Termination for ECL level signals
+3 V	Termination for PECL level signals

6. Now the setting is completed. To enable the change, press the OK button.

5.4.4 Setting the Clock input interface

This section describes the procedures for setting the Clock input interface of the MU163240A 3.2G Error Detector (hereafter called the ED unit).

1. Open the 'Setup: Clock I/F' panel.

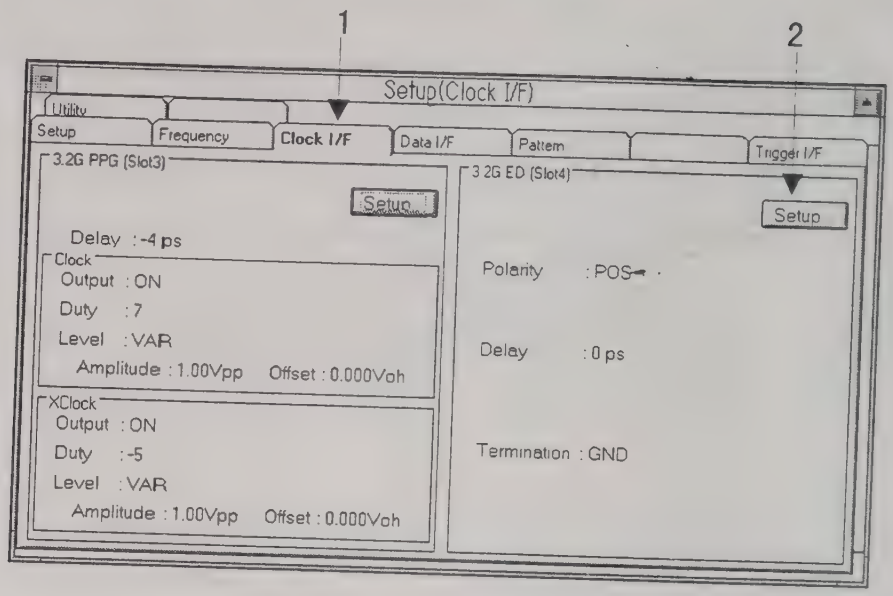


Fig. 5-28 Setup: Clock I/F panel

2. Press the Setup button in the ED group box. The Clock Interface dialog box will be opened.

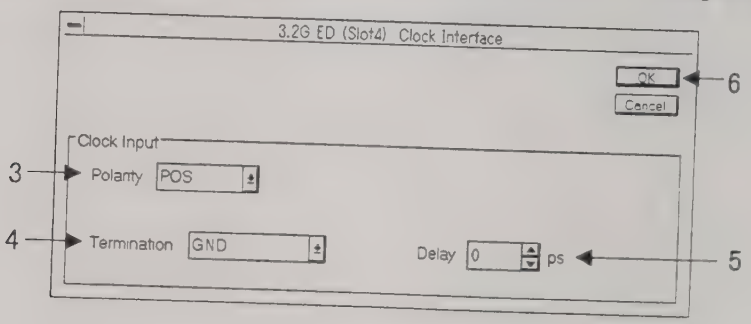


Fig. 5-29 Clock Interface dialog box

3. Set the Clock polarity by selecting from the Polarity drop-down list box.

4. Set the termination condition for clock input by selecting from the Termination drop-down list box.

GND	Ground termination
-2 V	Termination for ECL level signal
+3 V	Termination for PECL level signal

5. Set the delay by entering a value in the Delay spin box. The setting range is between -1000 ps and +1000 ps, and the resolution is 2 ps.

6. Now the setting is completed. To enable the change, press the OK button.

5.5.1 Selecting a synchronization method

The MU163240A 3.2G ED unit (hereafter called the ED unit) has the auto sync function to prevent excessive error occurrence resulting from cycle shifts by automatically taking the pattern cycles of the reference pattern inside the ED unit and input pattern during measurements. Two modes of "Normal" and "Frame" are available as the Pattern Sync mode for the synchronization of pattern cycles. For differences of the synchronization methods between these two modes, see "Appendix C Auto Sync". Each mode is under the following restrictions depending on the types and contents of patterns being received.

(PRBS pattern)

The Pattern Sync mode cannot be selected.

(PRGM pattern)

The Frame synchronization cannot be selected if the pattern length is less than 8 bits, or there is no change of 0 → 1 or 1 → 0 in the first 32 bits of the PRGM pattern.

(Zero-Subst pattern)

Both Pattern Sync modes can be selected.

5.5.2 Synchronizing with the receive pattern

1. Open the 'Setup: Pattern' panel.

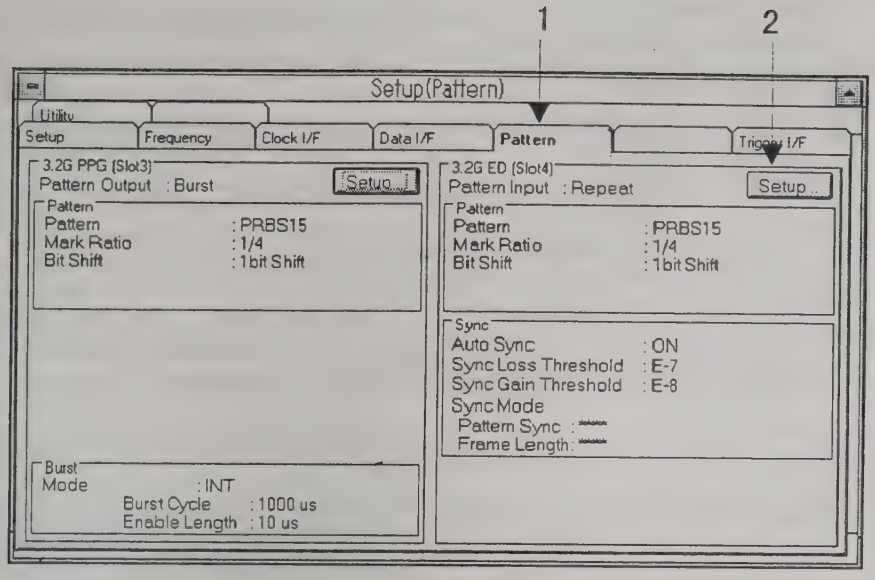


Fig. 5-30 Setup: Pattern panel

2. Press the Setup button in the group box of the ED unit. The Pattern dialog box will be opened. Carry out the following settings in the Sync Setting group box.

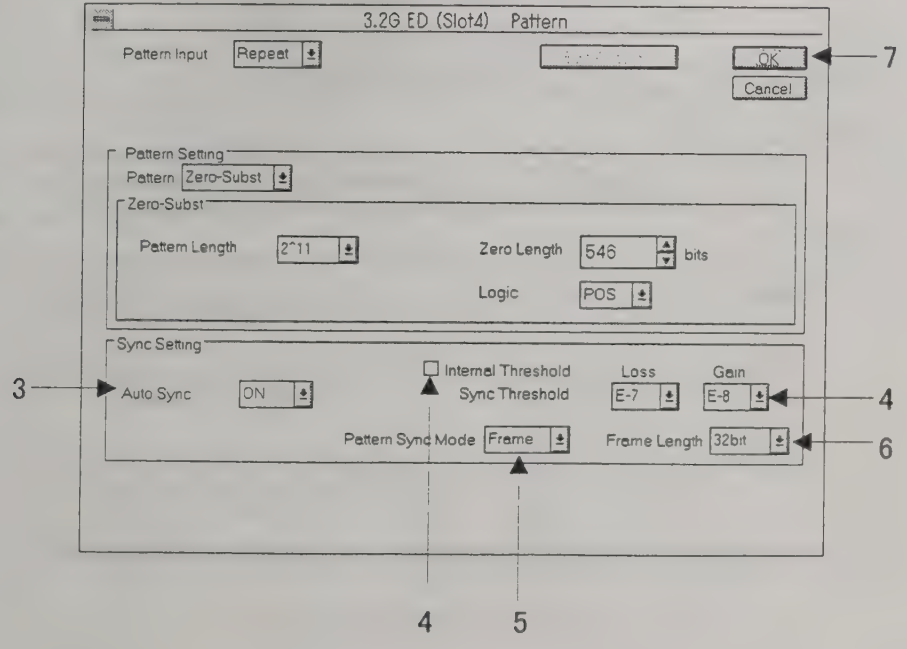


Fig. 5-31 Pattern dialog box

3. Set ON/OFF of the auto sync function by selecting from the Auto Sync drop-down list box.

4. Set the threshold value for determining asynchronization by selecting from the Sync Loss Threshold drop-down list box and Sync Gain Threshold drop-down list box, or Internal Threshold check box.

Sync Loss Threshold	1E-2, 1E-3, 1E-4, 1E-5, 1E-6, 1E-7
Sync Gain Threshold	1E-3, 1E-4, 1E-5, 1E-6, 1E-7, 1E-8

Note

Only greater values can be selected for Sync Loss Threshold than those for Sync Gain Threshold. If Internal Threshold is checked, Sync Loss Threshold and Sync Gain Threshold cannot be set. For the threshold values for synchronization / asynchronization when Internal Threshold is checked, refer "Appendix J Internal Threshold".

5. Set the pattern synchronization method by selecting from the Pattern Sync Mode drop-down list box.

Normal	Synchronized by rearrangement of Demux and bit shifts
Frame	Synchronized using the specified frame

6. Set the frame length if you have set the pattern synchronization mode in Procedure 5 to "Frame" by selecting from the Frame Length drop-down list box.

8 bit	Sets the frame length to 8 bits.
16 bit	Sets the frame length to 16 bits.
24 bit	Sets the frame length to 24 bits.
32 bit	Sets the frame length to 32 bits.

Note

A frame longer than the pattern length cannot be set. If there is no change of $0 \rightarrow 1$ or $1 \rightarrow 0$ in the starting part of the PRGM pattern to be specified, its frame length cannot be specified.

7. Now the setting is completed. To enable the change, press the OK button.

MU163240A 3.2G Error Detector (hereafter called the ED unit) has two kinds of search functions.

Auto Search function for the phase/threshold level

Optimal values for the phase relation between data and clock, and threshold level for input data are respectively detected automatically based on the error rate. You can also search the optimal values for both the phase relation and threshold level simultaneously.

Pattern search function

The number of steps and the mark ratio are searched, assuming that the input data signal is the PRBS pattern.

Note

Under bellow condition the auto search function is invalid.

(1) The auto sync function is "OFF"

(2) Pattern input mode (on the 'Setup:Pattern' of ED) is "Burst".

For details on how to set the auto sync function, see procedure 3 of "5.5.2 Synchronizing with the receive pattern". For details on how to set the burst pattern, see "5.3.2 Receiving the burst pattern ".

1. Open the Result subwindow.

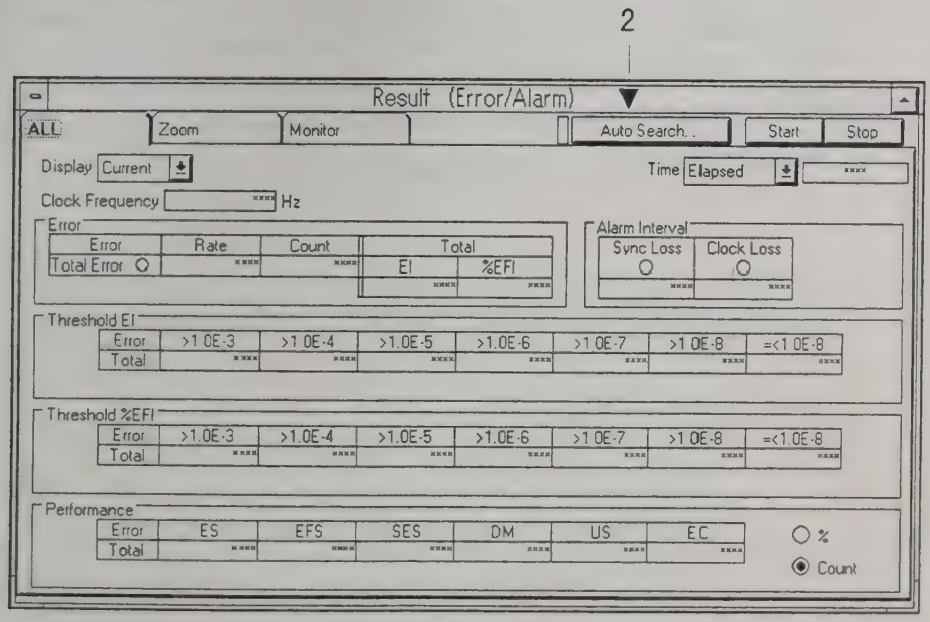


Fig. 5-32 Result: All panel

2. Press the Auto Search button. The Auto Search dialog box will be opened. Figure 5-32 shows the case of a Result subwindow when the error/alarm measurement is specified in the Test Menu subwindow. This operation is the same if other measurements are specified.

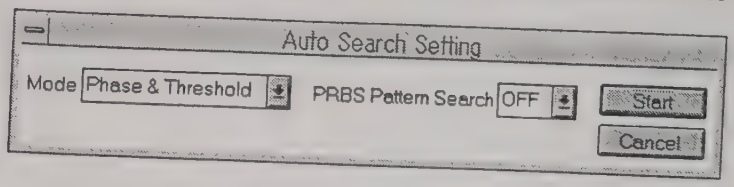


Fig. 5-33 Auto Search dialog box

3. Set the operation mode of the Auto Search by selecting from the Mode drop-down list box.

Phase & Threshold	Searches the optimal values for both the threshold level and phase.
Threshold	Searches the optimal value for the threshold level.
Phase	Searches the optimal value for the phase.
OFF	Do not perform the Auto Search of the threshold level and phase

4. Set ON/OFF of the pattern search by selecting from the PRBS Pattern Search drop-down list box.

Note

If the mark ratio of the whole receive pattern is extremely low or extremely high, the auto search in the threshold direction cannot work normally. The auto search may fail if "Normal" is set as the synchronization method for the PRGM pattern, and the frequency is low.

5. If you press the Start button, the auto search starts.

6. When the Auto Search starts, a dialog box for monitoring opens. If you want to cancel the Auto Search, press the Cancel button.

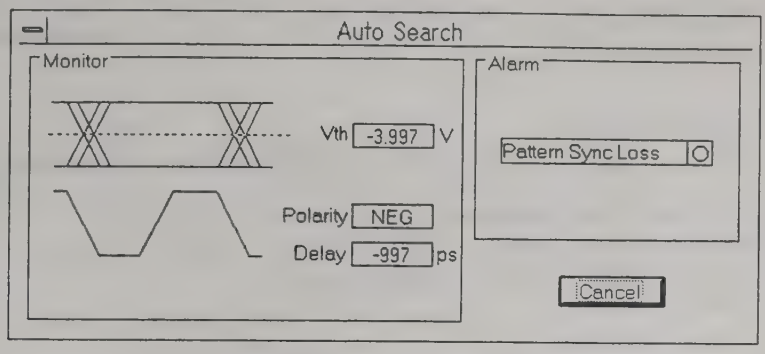


Fig. 5-34 Auto Searching dialog box

Note

You cannot press the Start button if both the auto search operation mode and pattern search are "OFF".

5.7.1 Functions

The MU163240A 3.2G Error Detector (called the ED unit) can measure the following items as error/alarm measurements.

Error measuring items

ER EC EI %EFI Threshold EI Threshold %EFI

Error performance (conforming to ITU-T G.821)

ES EFS SES DM US ES
%ES %EFS %SES %DM %US

Alarm measuring items

- Power failure/recovery time
- Clock loss/recovery time
- Sync loss/recovery time
- Power failure interval
- Clock loss interval
- Sync loss interval

As the error detection mode, you can select from the insertion error (INS error), loss error (OMI error), and Total error. The INS error is an error in which the bit 0 of the reference pattern is inverted into the bit 1. Conversely, the OMI error is an error in which the bit 1 of the reference pattern is inverted into the bit 0. In Total error detection mode, both types of errors are detected without making any distinction.

If you select INS/OMI as the error detection mode, INS errors and OMI errors can be measured simultaneously.

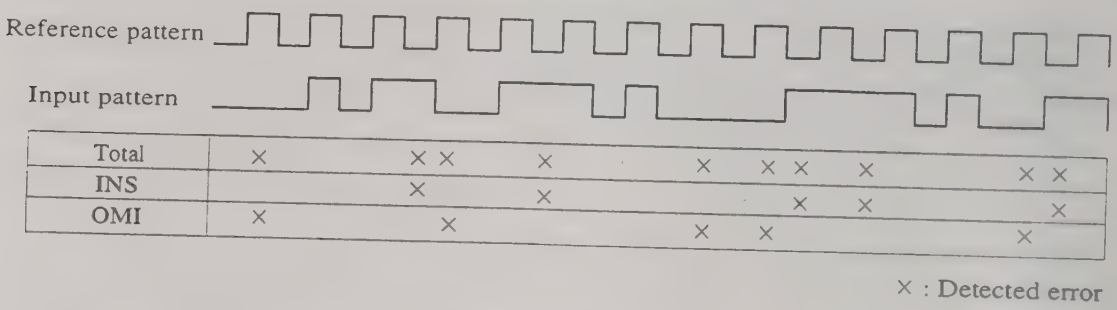


Fig. 5-35 Differences of errors depending on the error detection mode

5.7.2 Setting measuring conditions

1. Open the 'Test Menu: Measurement' panel and then select "Error/Alarm" from the Test Item drop-down list box.

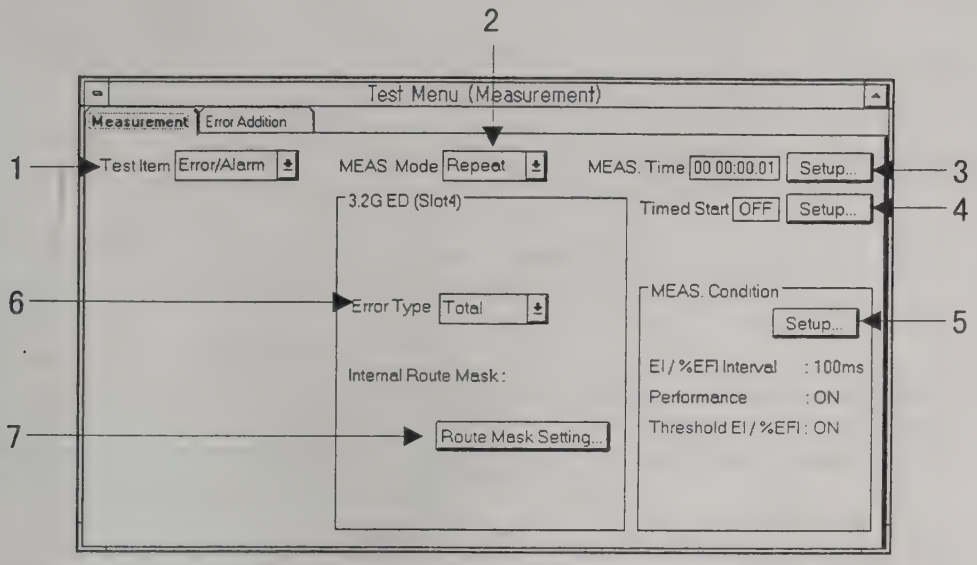


Fig. 5-36 Test Menu: Measurement panel (Error/Alarm)

2. Set the measuring mode by selecting from the MEAS. Mode drop-down list box. If you select "Untimed", you need not set for procedure 3.

Repeat	Repeats measurements of the measuring interval.
Single	Ends measurements after one measuring interval.
Untimed	Performs measurements from the measurement start instruction to the end instruction.

3. Set the time for one measuring cycle. Press the Setup button, and the Measurement Time dialog box will be opened. Enter the time for one measuring interval in the spin box and then press the OK button.

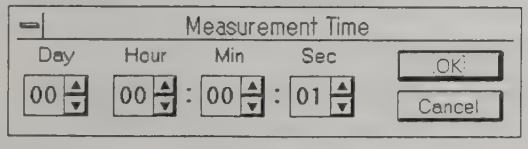


Fig. 5-37 Measurement Time dialog box

4. To set the measurement start time, press the Setup button. The Timed Start dialog box will be opened.

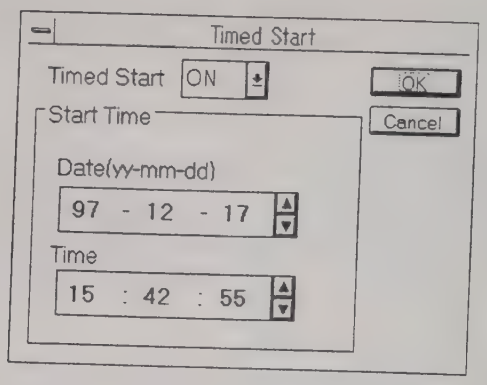


Fig. 5-38 Timed Start dialog box

4-1. Select "ON" from the Timed Start drop-down list box.

4-2. Enter the date and time in the spin box.

4-3. To enable the change, press the OK button.

5. To set a variety of measuring conditions, press the Setup button in the MEAS Condition group box. The Measurement Condition dialog box will be opened.

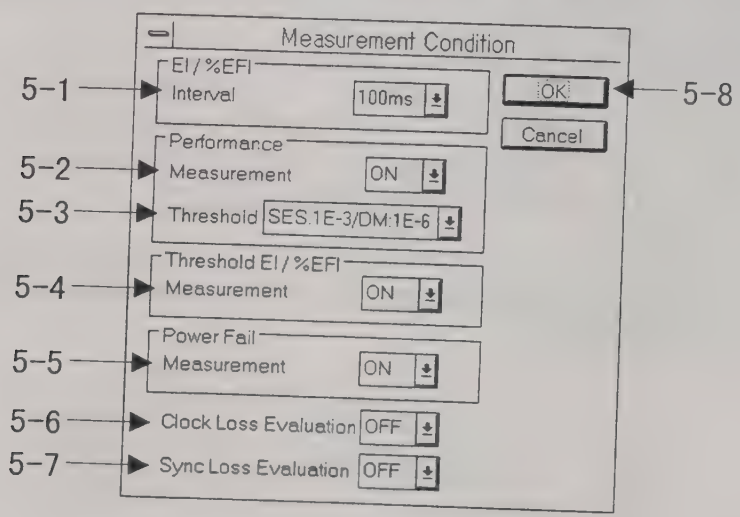


Fig. 5-39 Measurement Condition dialog box

5-1. Set the intervals for EI and %EFI. Select either 100 ms or 1 s from the Interval drop-down list box.

5-2. Set ON/OFF of the performance measurement by selecting from the Measurement drop-down list box.

5-3. Select the threshold value for calculating SES and DM from the Threshold drop-down list box. You cannot set this value if the Measurement is "OFF".

SES:1E-3/DM:1E-6	Threshold value 10^{-3} for calculating SES and 10^{-6} for calculating DM
SES:1E-4/DM:1E-8	Threshold value 10^{-4} for calculating SES and 10^{-8} for calculating DM

5-4. Set ON/OFF of the Threshold EI and Threshold %EFI measurements by selecting from the Measurement drop-down list box in the Threshold EI/%EFI group box.

5-5. Set ON/OFF of the power failure measurements by selecting from the Measurement drop-down list box in the Power Fail group box.

Note

When carrying out settings on the 'System: System' panel, you cannot specify this setting if the system operation mode does not allow measurements during power failure. For details on the system operation modes, see "6.4 Setting System Operations" of the operation manual of the MP1632A Digital Data Analyzer.

5-6. Set the processing during clock loss by selecting from the Clock Loss Evaluation drop-down list box.

ON	The interval of clock loss is counted as a clock loss interval and also in the total interval calculation, but it is not counted as an error interval. The interval of clock loss becomes an unavailable interval. If it is counted as an available period, it is also counted in the error second calculation.
OFF	The interval of clock loss is counted only as a clock loss interval and is not counted for any other item. The interval of clock loss is counted neither as an unavailable nor an available period. Also an interval being determined is counted neither as an available nor an available period.

In each case, the error count and clock count made during clock loss are excluded from the calculation.

5-7. Set the processing during sync loss by selecting from the Sync Loss Evaluation drop-down list box.

ON	The interval of sync loss is counted as a sync loss interval and also in the total interval calculation, but it is not counted as an error interval. The interval of sync loss becomes an available interval. If it is counted as an available period, it is also counted in the error second calculation.
OFF	The interval of sync loss is counted only as a sync loss interval and is not counted for any other item. The interval of sync loss is counted neither as an unavailable nor an available period. Also an interval being determined is counted neither as an unavailable nor an available period.

In each case, the error count and clock count made during sync loss are excluded from the calculation.

5-8. Now the setting is completed. To enable the change, press the OK button.

6. Set the error detection method by selecting from the Error Type drop-down list box in the group box of the ED unit.

Total	Detects the insertion errors and omission errors together.
INS/OMI	Detects the insertion errors and omission errors separately.

7. To mask the internal route of the ED unit, press the Route Mask Setting button. The Route Mask dialog box will be opened.

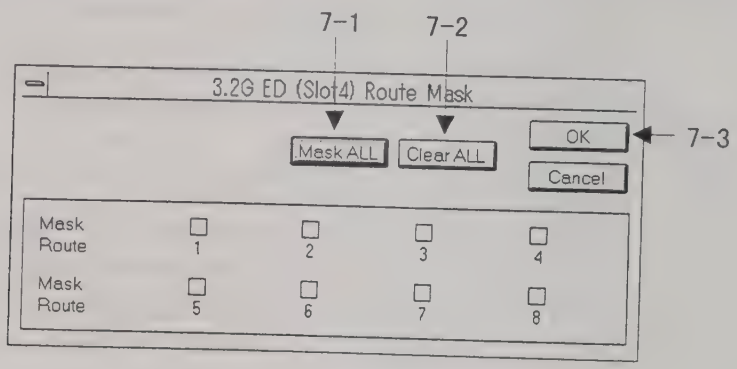


Fig. 5-40 Route Mask dialog box

7-1. To mask all routes press the Mask All button.

7-2. To unmask all routes press the Clear All button.

7-3 Now the setting is completed. To enable the change, press the OK button.

Note

For details of internal route mask, refer to "Appendix I Internal Route Mask".

8. Before starting measurements, see the next section.

5.7.3 Starting error/alarm measurements

You can start and stop measurements using a Result subwindow or the toolbar. Open the Result subwindow after checking that Error/Alarm is selected from the Test Item drop-down list box on the 'Test Menu: Measurement' panel. You can start measurements by pressing the Start button at upper right corner of the Result subwindow.

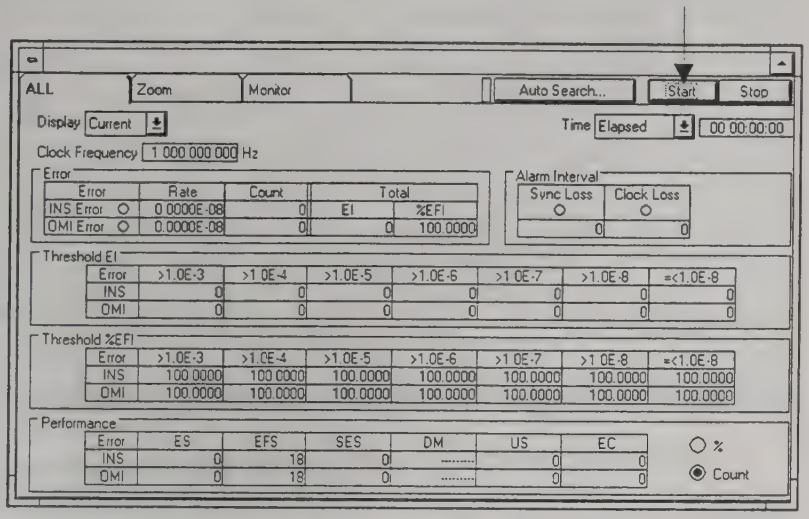

ALL
Zoom
Monitor
Auto Search...
Start
Stop
Display Current
Time Elapsed 00:00:00:00
Clock Frequency 1 000 000 000 Hz
Error
Error | Rate | Count | Total | EI | %EFI
INS Error | 0.0000E-08 | 0 | 0 | 100.0000
OMI Error | 0.0000E-08 | 0 | 0
Alarm Interval
Sync Loss | Clock Loss
0 | 0
Threshold EI
Error | >1.0E-3 | >1.0E-4 | >1.0E-5 | >1.0E-6 | >1.0E-7 | >1.0E-8 | =<1.0E-8
INS | 0 | 0 | 0 | 0 | 0 | 0 | 0
OMI | 0 | 0 | 0 | 0 | 0 | 0 | 0
Threshold %EFI
Error | >1.0E-3 | >1.0E-4 | >1.0E-5 | >1.0E-6 | >1.0E-7 | >1.0E-8 | =<1.0E-8
INS | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000
OMI | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000 | 100.0000
Performance
Error | ES | EFS | SES | DM | US | EC
INS | 0 | 18 | 0 | ..... | 0 | 0
OMI | 0 | 18 | 0 | ..... | 0 | 0
%
Count

Fig. 5-41 Measurement start button

The gauge in the parent window works during measurements to indicate that measurements are being performed. Measurement progress is displayed in the Result subwindow. The following three modes are available for displaying the measurement progress. You can switch these display modes using the tab in the Result subwindow.

· ALL	Displays error and alarm measuring results simultaneously. You must select the performance measuring count or % value.
· Zoom	Up to four measuring items are selected and then displayed with scale-up.
· Monitor	Whether errors or alarms have occurred is displayed using images on the LED display.

"*****" or "-----" may be displayed as measuring results. The meanings of each of them are listed below. They are common to the whole display mode.

*****	Indicates a measuring item that is excluded from measurement.
-----	Indicates that, for some reason, valid measuring results are not obtained.

(1) ALL display mode

1. Open the 'Result: All' panel.

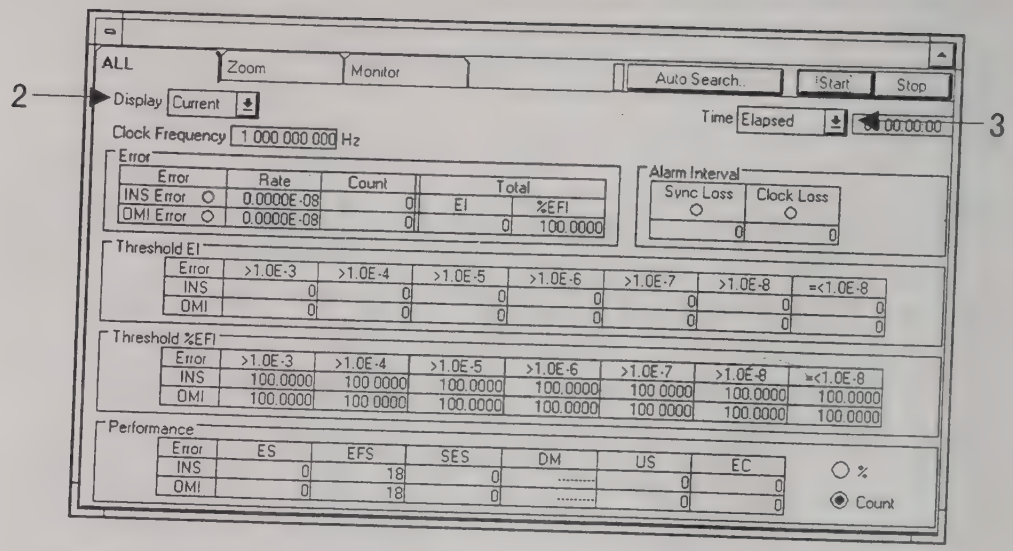


Fig. 5-42 Result: All panel (during error/alarm measurements)

2. Set the display format of measurement progress by selecting from the Display drop-down list box.

Current	Displays accumulated results of measured data up to now in real time.
Last	Displays the results of the last completed measuring cycle. The display content is not updated until the next measuring cycle is completed.

3. Set the mode of the time display by selecting from the Time drop-down list box.

Elapsed	Displays the elapsed time. If Meas. mode "Repeat" is selected, the elapsed time of the current measuring cycle is displayed.
Timed	Displays the remaining time of the measuring cycle. If Meas. mode "Repeat" is selected, the remaining time of the current measuring cycle is displayed. If Meas. mode Untimed is selected, this item cannot be selected.
Start	Displays the start time of measurements. If Meas. mode "Repeat" is selected, the start time of the current measuring cycle is displayed.
Date & Time	Displays the current date and time.

(2) Zoom display mode

1. Open the 'Result: Zoom' panel.

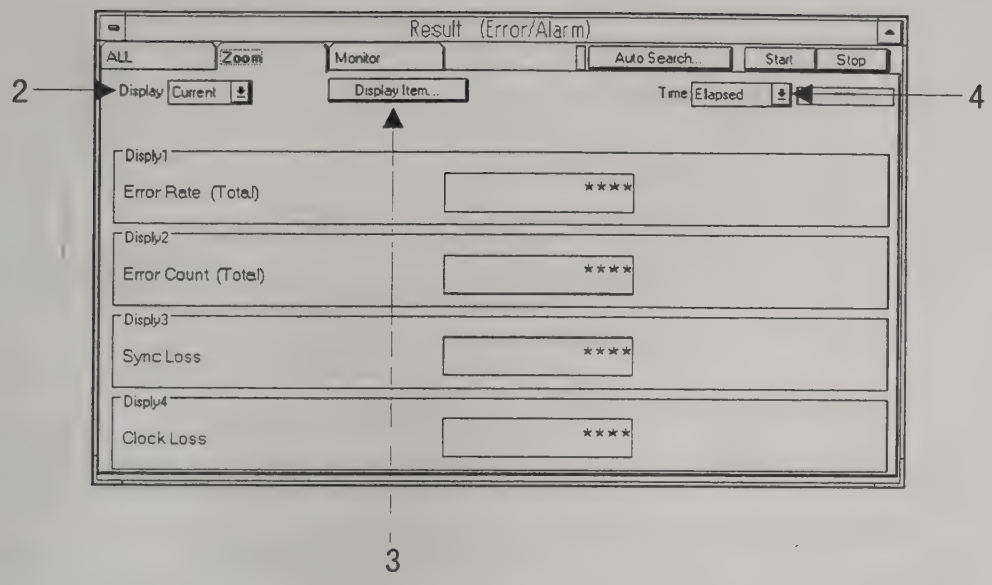


Fig. 5-43 Result: Zoom panel

2. Set the display format of measurement progress by selecting from the Display drop-down list box.

Current	Displays accumulated results of measured data up to now in real time.
Last	Displays the results of the last completed measuring cycle. The display content is not updated until the next measuring cycle is completed.

3. To select items to be displayed in each of the four scaled-up display areas. Press the Display Item button to open the Display Item Select dialog box.

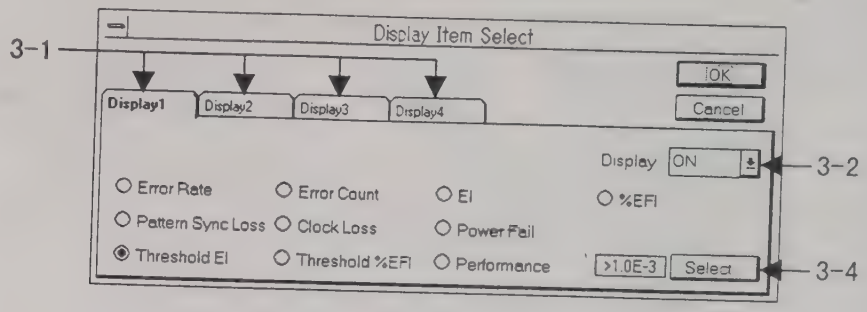


Fig. 5-44 Display Item Select dialog box

3-1. Open the panel corresponding to the display area to be set.

3-2. Select ON/OFF of the display from the Display drop-down list box.

3-3. Select items to be displayed marking the option button.

Note

You cannot select the Power Fail as a display item if the system operation mode does not allow power failure measurement. For details on the system operation mode, see "6.4 Setting System Operations" of the MP1632A Digital Data Analyzer operation manual.

3-4. If you select "Threshold EI" or "Threshold %EFI" as an item to be displayed, the Select button becomes valid. Press the Select button to open the Threshold EI/%EFI Select dialog box. Press the OK button after selecting the threshold value marking the option button.

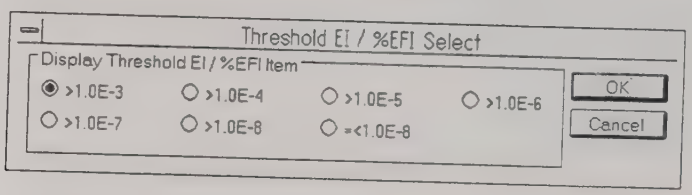


Fig. 5-45 Threshold EI/%EFI Select dialog box

3-5. If you select Performance as an item to be displayed, the Select button becomes valid. Press the Select button to open the Performance Item Select dialog box. Press the OK button after selecting the Performance item marking the option button.

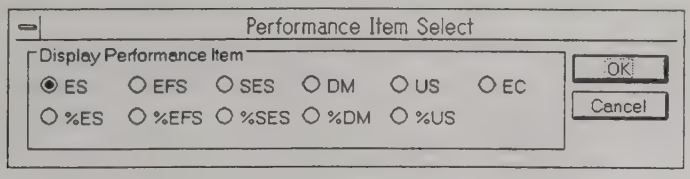


Fig. 5-46 Performance Item Select dialog box

Carry out the above setting for each display area.

3-6. To enable the change, press the OK button.

4. Select the display mode of the measuring time from the Time drop-down list box.

Elapsed	Displays the elapsed time. If Meas. mode "Repeat" is selected, the elapsed time of the current measuring cycle is displayed.
Timed	Displays the remaining time of the measuring cycle. If Meas. mode "Repeat" is selected, the remaining time of the current measuring cycle is displayed. If Meas. mode "Untimed" is selected, this item cannot be selected.
Start	Displays the start time of measurements. If Meas. mode "Repeat" is selected, the start time of the current measuring cycle is displayed.
Date & Time	Displays the current date and time.

(3) Monitor display mode

1. Open the 'Result: Monitor' panel.

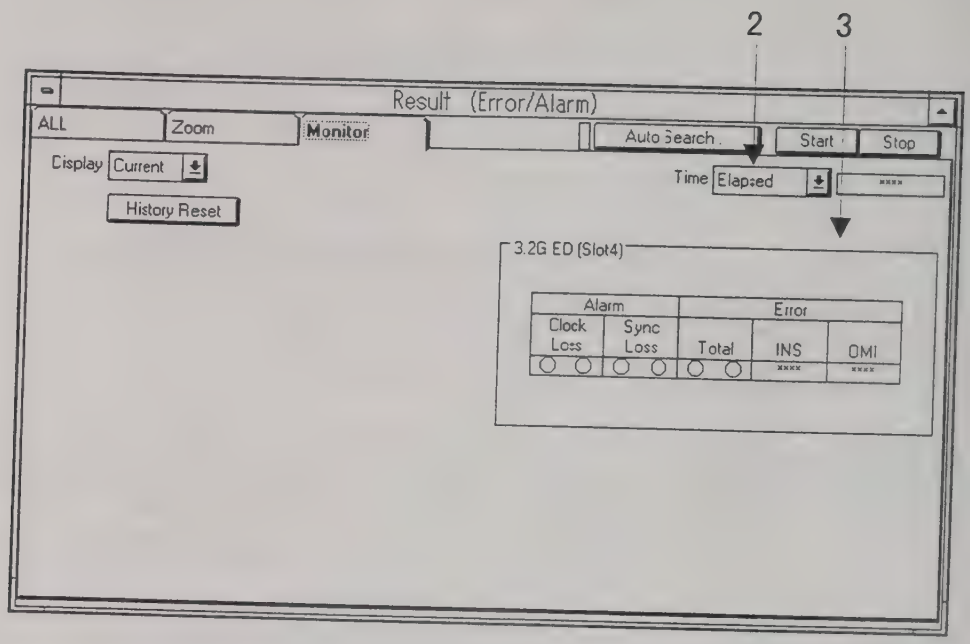


Fig. 5-47 Result: Monitor panel

2. Set the display mode of the measuring time by selecting from the Time drop-down list box.

Elapsed	Displays the elapsed time. If "Repeat" is selected, the elapsed time of the current measuring cycle is displayed.
Timed	Displays the remaining time of the measuring cycle.
Start	Displays the start time of measurements. If "Repeat" is selected, the start time of the current measuring cycle is displayed.
Date & Time	Displays the current date and time.

3. Two LEDs on the right and left sides of the measuring result display field signify the following.

Left LED (red): Real-time monitor. When an error/alarm occurs, it is turned ON in real time. If no error/alarm occurs, it is not turned ON.

Right LED (Yellow): History monitor. If an error/alarm occurs in the current measuring interval, it is turned ON and is not turned OFF until the end of the measuring cycle.

5.7.4 Printing measuring results

This section describes how to print measuring results of error/alarm measurements. When printing is requested, measuring results (intermediate measuring data created every second) at the time of the request are output once by this function. "Appendixes F Printer Output Format" shows output examples to a printer.

1. Select Print from the File menu of the parent window. The Print dialog box will be opened.

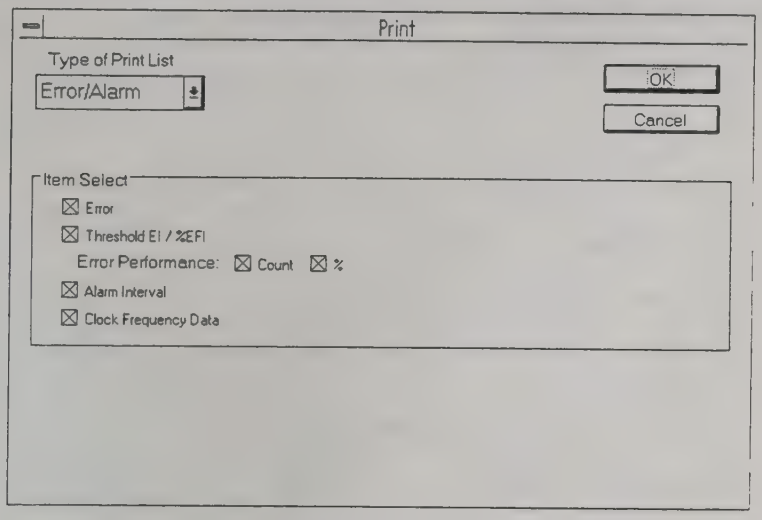


Fig. 5-48 Print dialog box

2. Select "Error/Alarm" from the Type of Print List drop-down list box.

3. Check the items to be printed in the Item Select group box.

Error	Outputs EC, ER, EI, and %EFI to end data.
Threshold EI/%EFI	Outputs Threshold EI and Threshold %EFI to end data.
Performance Count	Outputs EC, ES, EFS, SES, US, and DM to end data.
Performance %	Outputs %ES, %EFS, %SES, %US and %DM to end data.
Alarm Interval	Outputs the alarm interval to end data.
Clock Frequency Data	Outputs frequency measuring results to end data.

Note

1. If the Threshold EI/%EFI is "OFF", the Threshold EI/%EFI cannot be checked.
2. If the Performance is "OFF", the Performance Count and Performance % cannot be checked.

4. If you press the OK button, printing starts.

5.8.1 Setting error addition conditions

The MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) can send patterns with added errors. For details of error addition, see "Appendix E Error Addition".

1. Open the 'Test Menu: Error Addition' panel. You can see here the setting of the error addition method.

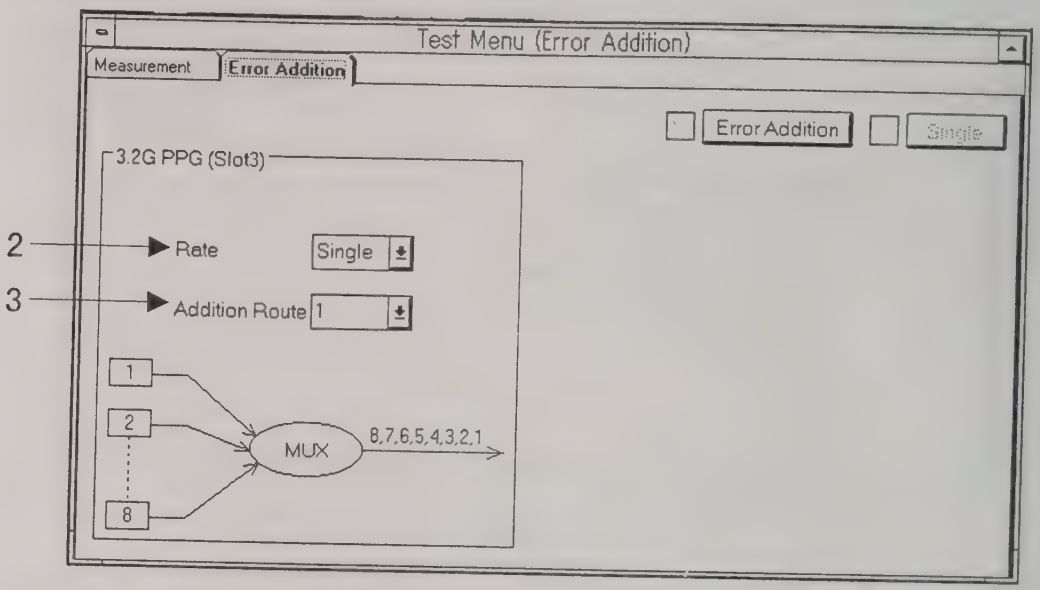


Fig. 5-49 Test Menu: Error Addition panel

2. Select the rate of errors to be added by selecting from the Rate drop-down list box.

1E-3 to 1E-9	Adds errors at the rate of 10^{-3} to 10^{-9}
Single	Adds one error at the timing of the Single button press.
EXT	Adds errors through input of the EXT Error Input connector

Specification of signal from the EXT Error Input is described bellow.

Amplitude	1 Vp-p ±20%
Offset (V_{IH})	0 V ±0.2 V
Pulse width	exceeding (8 / fundamental frequency)

3. Set the route of addition by selecting from the Addition Route drop-down list box.

5.8.2 Adding errors

To add errors under the condition set in "5.8.1 Setting error addition conditions", operation is needed on the 'Test Menu: Error Addition' panel during transmission.

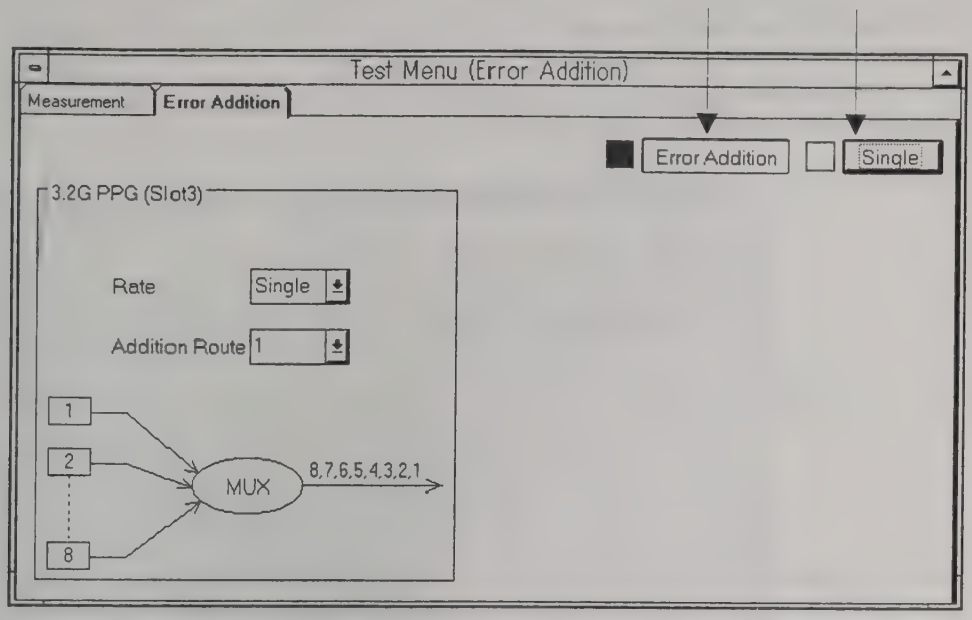


Fig. 5-50 Test Menu: Error Addition panel

(If Rate is Single)

Press the Error Addition button. The lamp at the side is turned ON. If you press the Single button while the lamp is turned ON, one bit of error is added at the timing of the button press.

(If Rate is other than Single)

Press the Error Addition button. The lamp at the side is turned ON to indicate that errors are being added. If you press the Error Addition button again, the lamp is turned OFF and error addition is stopped.

5.9.1 Customize subwindow

Customize subwindow is useful especially for BERTS users who are familier with 'one key one parameter' operation. With this subwindow, setting various parameters and monitoring the result can be done on one screen. For example, error rate can be measured with continuous changing delay of ED clock.
Customize subwindow consists of eight frames: (maximum) six Setup group boxes, one Result group box, and one ETC/ Pattern Edit group box.

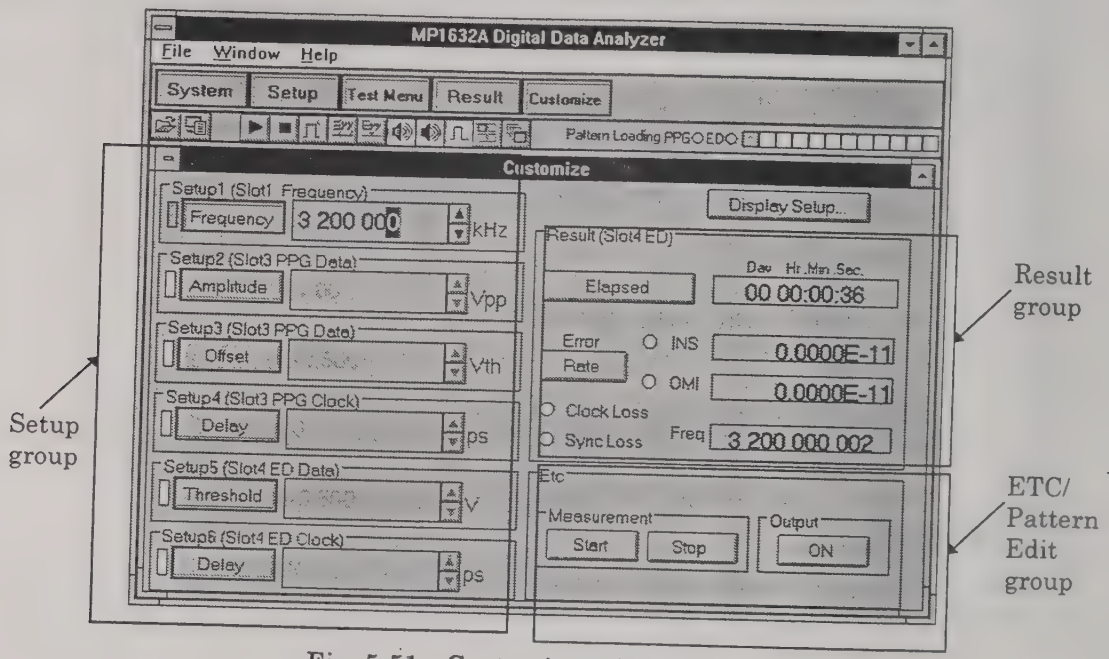


Fig. 5-51 Customize subwindow

To input the value of the parameters,

1. Press the button shown at the left of the parameter box (Frequency, Amplitude, etc at Fig.5-51) and the LED at the left of the button will turn on to indicate that the value is ready to be input.
2. Input the value with the numeric value entry keys or with the spin box at the right side of the parameter. Some parameters like POS or NEG can be set with drop-down list box. The value is effective as soon as the value is set.
3. Press the button shown at the left side of the parameter box again, and the LED will turn off to indicate that the value cannot be input until the button is pressed again. It is useful to prevent from accidental value changing.

Table 5-4 lists the setting items that can be assigned to the six Setup group boxes.

Table 5-4 Setting items that can be assigned to Setup group boxes

Setting items related to MU163220A	
Clock output interface	Amplitude*1, Offset*1, Delay*3, Duty
Data output interface	Amplitude*2, Offset*2, Cross Point
Send pattern	Mark Ratio, Logic, Pattern

Setting items related to MU163240A	
Clock input interface	Delay, Polarity
Data input interface	Threshold*2
Receive pattern	Mark Ratio, Logic, Pattern
Error/Alarm Measurement	Error Type, MEAS. Mode, MEAS. Time

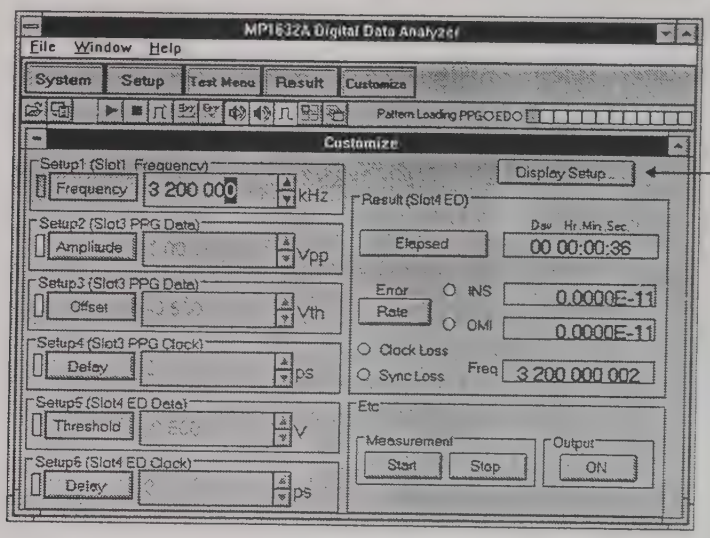
In addition, the parameters related to the internal synthesizer can be assigned. For details, refer to "6.15 For the Users of the Existing BERTS" in the MP1632A Digital Data Analyzer operation manual.

*1 This item cannot be assigned if "VAR" is not selected from the Level drop-down list box on the 'Setup: Clock I/F' panel.
*2 This item cannot be assigned if "VAR" is not selected from the Level drop-down list box on the 'Setup: Data I/F' panel.
*3 This item is common setting to Clock / X Clock

5.9.2 Assigning setting items to the Setup group boxes

This section describes the procedure for assigning setting items to Setup group boxes. A maximum of six items can be assigned.

1. Press the Display Setup button in the Customize subwindow.



Display Setup button

Fig. 5-52 Display Setup button in Customize subwindow

The Customize Window Display Setup dialog box will open.

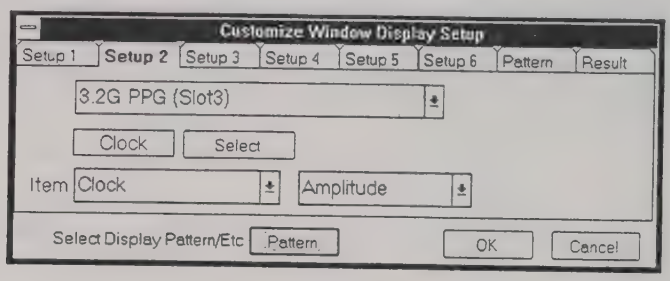

Customize Window Display Setup
Setup 1 Setup 2 Setup 3 Setup 4 Setup 5 Setup 6 Pattern Result
3.2G PPG (Slot3)
Clock Select
Item Clock Amplitude
Select Display Pattern/Etc Pattern
OK Cancel

Fig. 5-53 Customize Window Display Setup dialog box

2. Select a group box to which a setting item is to be assigned. Press a tab (Setup1 to Setup6) to open the desired panel.

3. When multiple units are used in combination, select the target unit from the Unit drop-down list box. When it is not necessary to assign any setting item, select "OFF". For the setting item assignment procedure to be followed when a unit other than "3.2G PPG" and "3.2G ED" is selected, refer to the Operation Manual that comes with the selected unit.

4. Select setting items from the Item drop-down list boxes. For the selectable setting items, see Table 5-4.

5. Perform steps 2 through 4 as many times as the number of items to be assigned.

6. This completes the setting. Press the OK button to make the new setting effective.

5.9.3 Assigning measurement items to the Result group box

This section describes the procedures for assigning measurement items to the Result group box. Without the ED unit, you cannot assign measurement items.

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

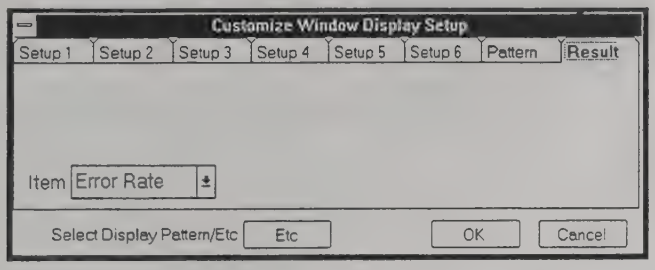


Fig. 5-54 Customize Window Display Setup dialog box

2. Press the Result tab.

Note

It is an impossible to assign the measurement item except on Error/Alarm measurement. When the selection in Test Item drop-down list box on Test Menu subwindow Measurement panel is "Eye Margin", Result tab is invalid.

3. Select the measurement items to be displayed in the Result group box, from the Item drop-down list.

Error Rate	Displays an error rate item in the Result group box.
Error Count	Displays an error count item in the Result group box.

4. This completes the setting. Press the OK button to make the new setting effective.

Note

It is possible to select the measurement item in the Result group box.

5.9.4 Editing a pattern in the Customize subwindow

This section describes how to edit a pattern in the Customize subwindow. When editing a pattern, assign target channels to the Panel Editor group box following the procedure described below.

- **Assigning to the Pattern Edit group box**

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

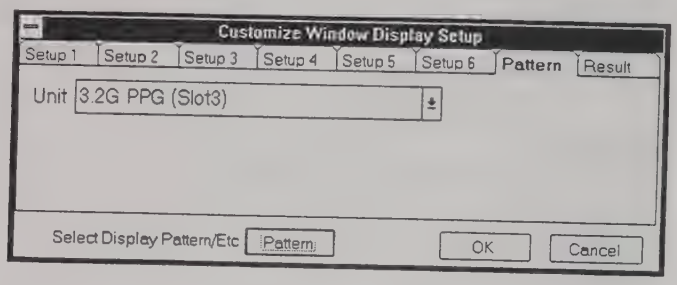


Fig. 5-55 Customize Window Display Setup dialog box

2. Press the Edit Pattern tab.

3. When multiple units are used in combination, select the target unit from the Unit drop-down list box. When it is not necessary to assign any setting item, select "OFF".

4. Select "Pattern" by pressing the Select Display Pattern/Etc button. Its Pattern/Etc status changes as often as the Select Display Pattern/Etc button is pressed.

5. Press the OK button to make the new setting effective. The Customize Display Window Setup dialog box will close.

- **Editing a pattern**

After assigning the unit to the group box, edit a pattern. It should be noted that PRBS and Zero-Subst patterns cannot be edited.

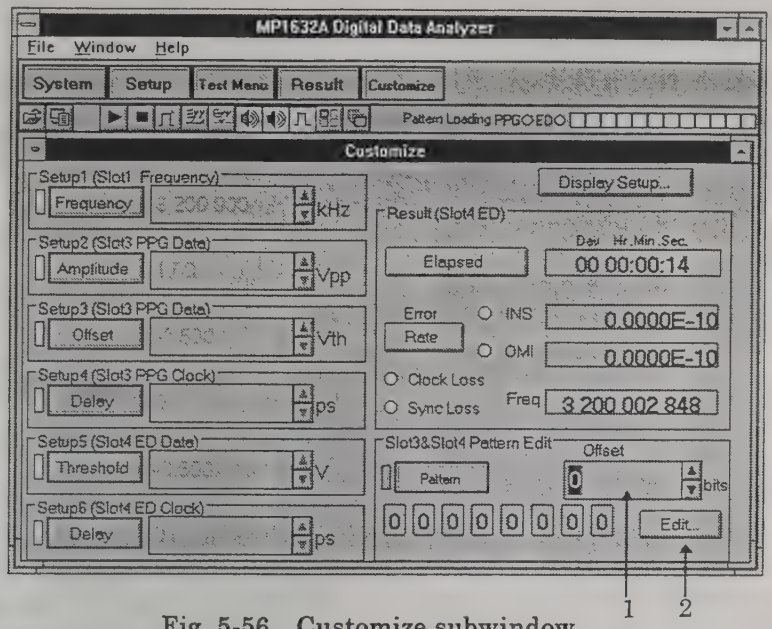


Fig. 5-56 Customize subwindow

1. Specify the bit positions of the target pattern. Use the Offset spin box for this specification.

2. Input the pattern byte by byte. Press the Edit button to open the Pattern Edit dialog box.

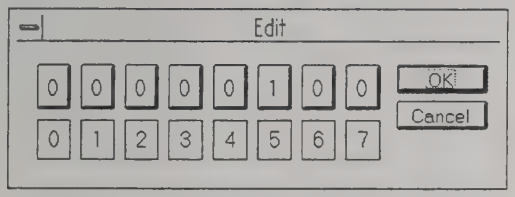


Fig. 5-57 Edit dialog box

3. Press bit number buttons. The selected bits will be inverted.

4. Press the OK button to allow the new pattern take effect.

5. Repeat steps 2-4 as required.

5.9.5 Starting Error/Alarm measurements in the Customize subwindow

This section describes the procedures for assigning "start measurement" and "stop measurement" buttons to the Pattern group box.

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

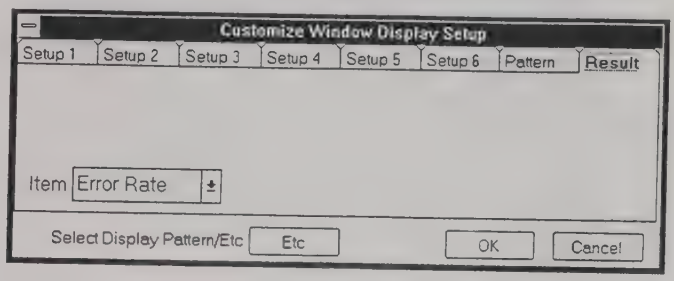


Fig. 5-58 Customize Window Display Setup dialog box

2. Select "Etc" by pressing the Select Display Pattern/Etc button. Its Pattern/Etc status changes as often as the Select Display Pattern/Etc button is pressed.

3. This completes the setting. Press the OK button to make the new setting effective.

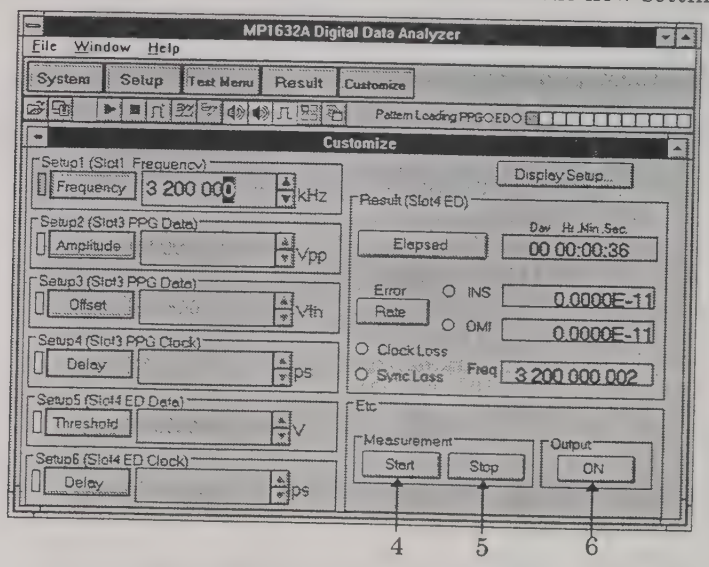


Fig. 5-59 Customize subwindow

4. Start measurement by pressing the start button.

5. Stop measurement by pressing the stop button,

6. Set On/Off of the data/clock output by pressing the Output button. Its On/Off status changes as often as the Output button is pressed.

5.9.6 Result group box in Customize subwindow

Result group box shows,

1. Elapsed or Timed (Remaining) Measurement Time
   * Elapsed / Timed indication is toggled by clicking the Elapsed / Timed selection button.

2. Error Indication and Error Rate or Error Count
   * INS/OMI Error / TOTAL Error can be selected at Error Type box, Measurement panel in Test Menu subwindow. See '5.7.2 Setting measuring conditions'.
   * Error Rate / Error Count is toggled by clicking the Rate/Count selection button

3. Clock Loss Indication and Sync Loss Indication

4. The frequency gotten by counting the frequency of Clock Input at ED (Error Detector).

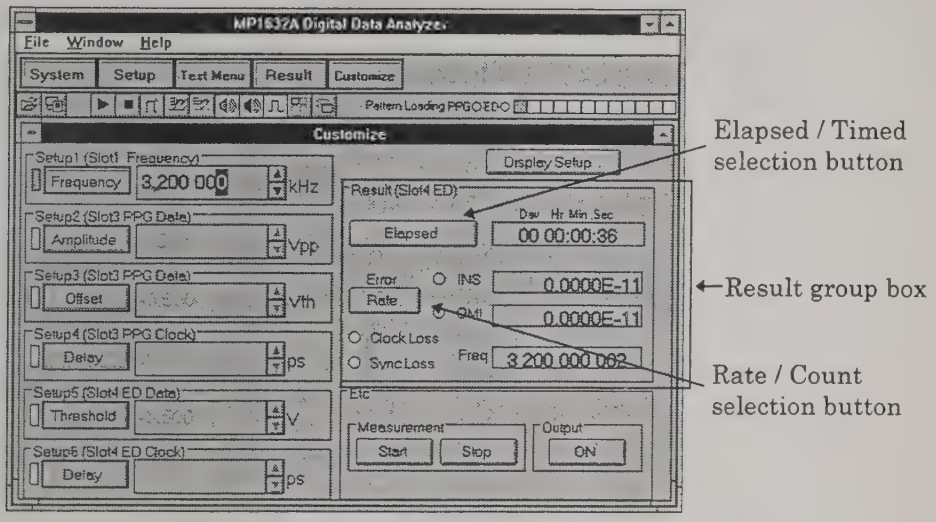


Fig. 5-60 Result group box in Customize subwindow

5.10.1 Saving Setting Data in Data Files

The MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) and the MU163240A 3.2G Error Detector (hereafter called the ED unit) allow you to save the setting data in data files.
Data files are classified by unit type. The PPG unit setting data file can be distinguished from the ED unit setting data file according to their file name extensions. The file name extension of the PPG unit setting data file is ".PPG". The file name extension of the ED unit setting data file is ".ED".
The above setting data files do not contain pattern-related setting data (setting items that exists on the 'Setup: Pattern' panel). Pattern-related setting data of the PPG and ED units are saved as pattern data files with a file name extension ".PTN".
For example, when the PPG unit and the ED unit are installed, a total of four files, a .PPG file, an .ED file, and two .PTN files-are generated.

Data file	Description
.PPG	A PPG unit setting data file (not including pattern-related setting data).
.ED	An ED unit setting data file (not including pattern-related setting data).
.PTN	A pattern data file including pattern-related setting data of ED and the PPG units.

1. Select "Save" from the File menu in the parent window to open the Save dialog box.

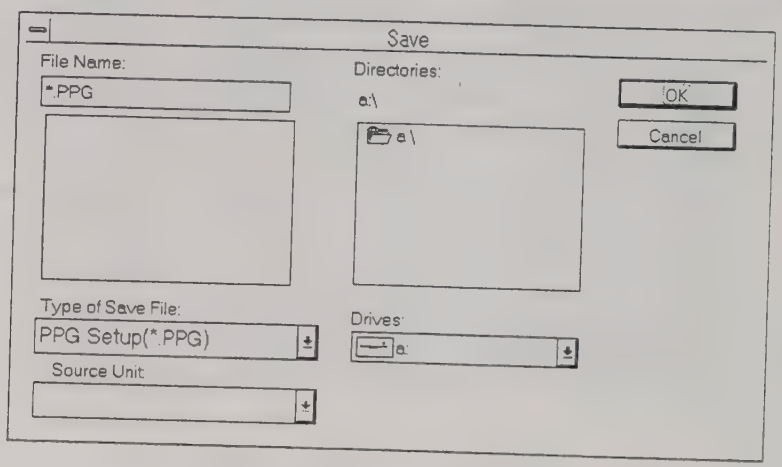


Fig. 5-61 Save dialog box

2. Select a save file type from the Type of Save File drop-down list box.

PPG Setup (*.PPG)	Saves setting data of the PPG unit.
ED Setup (*.ED)	Saves setting data of the ED unit.
Pattern Data (*.PTN)	Saves pattern-related setting data and the generated pattern data.

3. When multiple units are used in combination and file type is "*.PTN", select the target unit from the Unit drop-down list box.

4. Specify the names of the drive, directory, and file, then press the OK button. Do not change the file name extension. If drive D is specified, setting data will not be saved.

5.10.2 Opening Data Files

The MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) and the MU163240A 3.2G Error Detector (hereafter called the ED unit) allow you to open the data files storing setting data.
Data files are opened on a unit basis. The PPG unit setting data file can be distinguished from the ED unit setting data file according to their file name extensions. The file name extension of the PPG unit setting data file is ".PPG". The file name extension of the ED unit setting data file is ".ED".
The above setting data files do not contain pattern-related setting data (setting items that can be checked on the 'Setup: Pattern' panel). Pattern-related setting data of the PPG and ED units are saved as pattern data files with a file name extension ".PTN".

Data file	Description
.PPG	A PPG unit setting data file (not including pattern-related setting data).
.ED	An ED unit setting data file (not including pattern-related setting data).
.PTN	A pattern data file including pattern-related setting data of the ED or the PPG units.

1. Select "Open" from the File menu in the main window to select the Open dialog box.

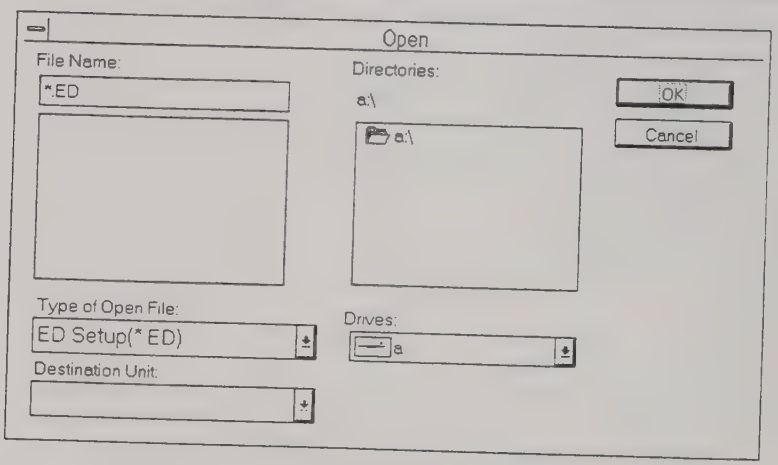


Fig. 5-62 Open dialog box

2. Select an open file type from the Type of Open File drop-down list box.

PPG Setup (*.PPG)	Opens setting data of the PPG unit.
ED Setup (*.ED)	Opens setting data of the ED unit.
Pattern Data (*.PTN)	Opens pattern-related setting data and the generated pattern data.

3. When multiple units are used in combination and file type is "*.PTN", select the target unit from the Destination Unit drop-down list box.

4. Specify the names of the drive, directory, and file, then press the OK button.

Note

In opening *.PTN file, you don't need to care which unit creates it. For example you can open *.PTN file saved by the ED unit to the PPG unit. In such a case, Setting items particular to the ED unit is ignored. All items in the Sync Setting group box are such items. Setting items particular to the PPG unit are the Mode and Burst Cycle in the Burst Setting group box.

(Blank)

CHAPTER 6 APPLICABLE OPERATIONS

6.1.1 Tracking function

The MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) has setting items of each output ports separately. 'Setup: Clock I/F' and 'Setup: Data I/F' panels are provided with a tracking function which allows those setting items to be set at a time.

6.1.2 Making settings for Tracking

This section describes how to enable the tracking function taking as an example the clock interface setting.

1. Press the Setup button on the 'Setup: Clock I/F' panel to open the Clock Interface dialog box.

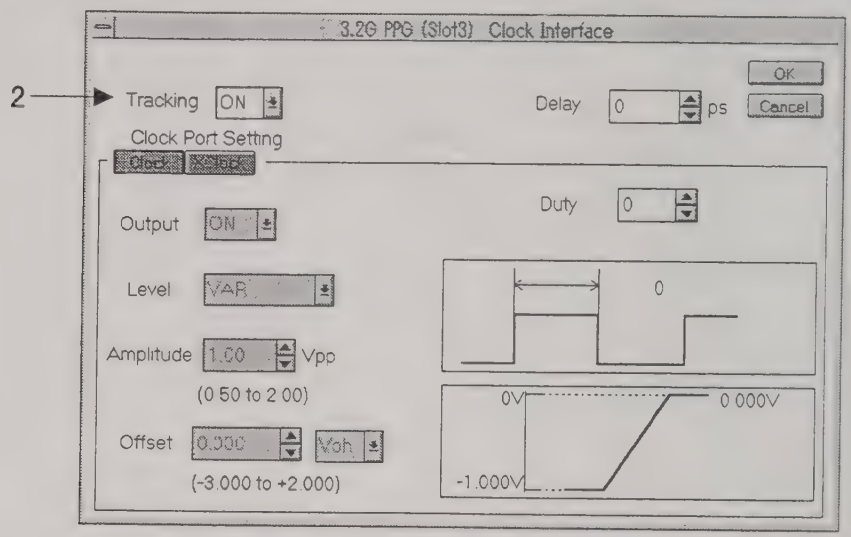


Fig. 6-1 Clock Interface dialog box

2. Select "ON" from the Tracking drop-down list box. Setting items subject to tracking are highlighted.

Note

Duty on the Clock Interface dialog box and Cross Point on the Data Interface dialog box are not subject to tracking. In Addition, delay setting on the Clock Interface dialog box is always common to Clock and X Clock.

When MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) and MU163240A 3.2G Error Detector (hereafter called the ED unit) are inserted into the MP1632A main frame, setting items of each units exist separately.

For above reason, if you want the PPG unit and ED unit to be same pattern type, you must set pattern twice on each dialog boxes. To save such trouble, there is function which allows pattern setting items to be common to the units.

Although setting items which influence only the PPG or the ED unit (e.g. setting items in the Sync Setting group box is not for the PPG but for the ED) also appear, operation of such items doesn't influence the other one of units.

This section describes here how to make pattern setting common to units.

1. Open the 'Setup: Setup' panel.

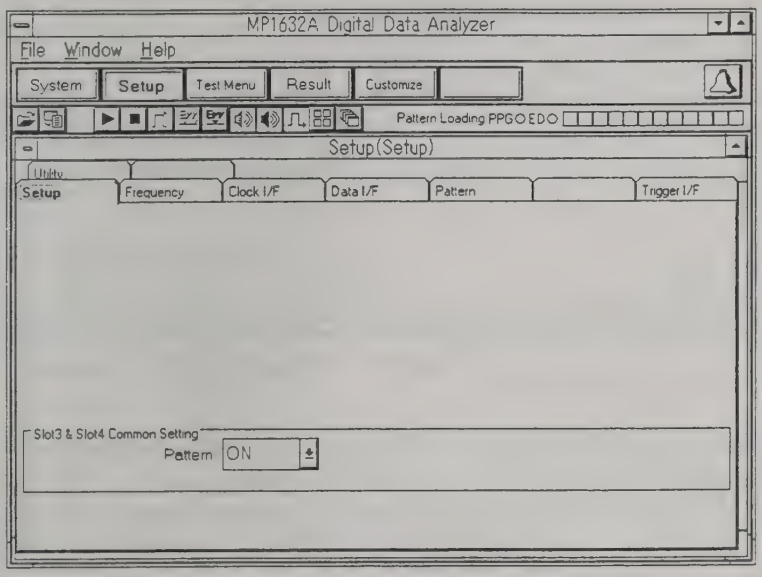


Fig. 6-2 Setup: Setup panel

2. Select "ON" from the Pattern drop-down list box in the Slot3 & Slot4 Common Setting group box.

   Note

   After selecting "ON" from the Pattern drop-down list box, pattern settings of the PPG unit are made same as the ED unit's.

3. Now the pattern settings become common to units. For setting, refer "5.1 Setting a Send/Receive Pattern"

MU163220A 3.2G Pulse Pattern Generator (hereafter called the PPG unit) and MU163240A 3.2G Error Detector (hereafter called the ED unit) have a Trigger Output connector. This section describes here the procedure for setting the Trigger Output.

1. Open the 'Setup: Trigger I/F' panel.

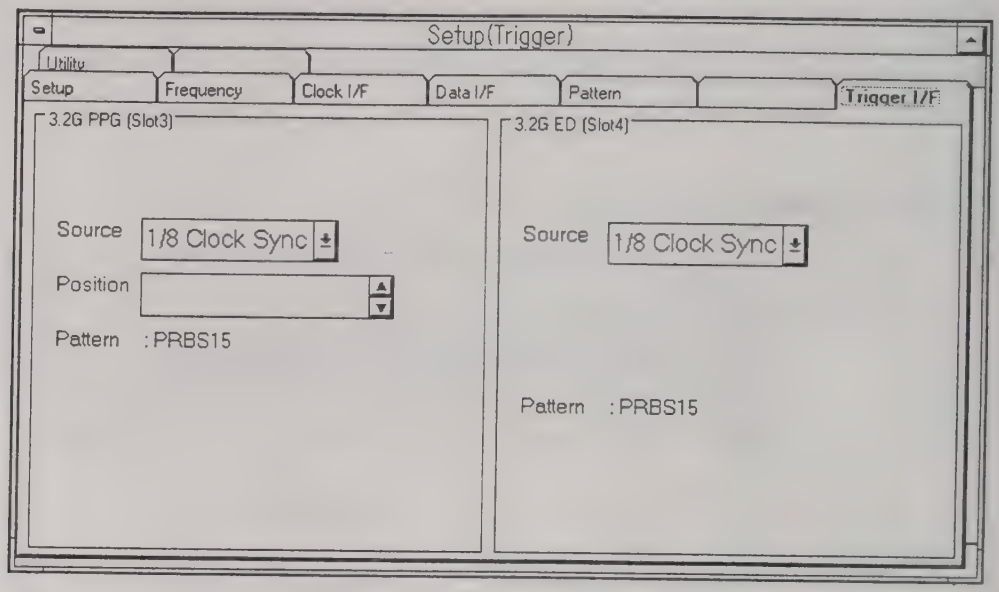


Fig. 6-3 Setup: Trigger I/F panel

2. Set signal type of the Trigger Output connector by selecting from the Source drop-down list box. Divide

1/8 Clock Sync	This output is the output clock (PPG unit) or the input clock (ED unit) divided by 8.
Pattern Sync	This output is 8 bit width pulse signal synchronized with the pattern cycle.
SYNC Gain/Loss (MU163240A only)	This output is low under SYNC loss state and high under SYNC gain state.

3. When the Pattern Sync is selected on the PPG side, enter the position that the trigger starts in the Position spin box.

Note

The step of the Position setting is 1 when pattern type is PRBS, and 8 when pattern type is PRGM or Zero-Subst.
SYNC Gain/Loss can be selected only for ED unit. For details of SYNC Gain/Loss during burst signal receiving, refer "Appendix H Measurement Extent During Burst Signal Receiving".

6.4.1 Functions

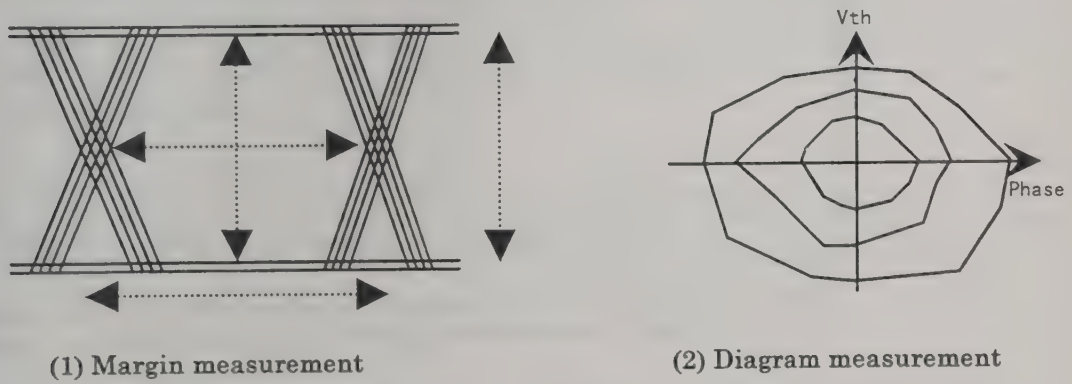
The MU163240A 3.2G Error Detector (hereafter called the ED unit) has a margin measurement function and a diagram measurement function to measure eye margins.

(1) Margin measurement

Threshold voltages and phases which are within the specified error rate range (i.e. margin) are measured. Both the threshold voltage and phase can be measured at the same time. The threshold margin is measured, starting with the threshold voltage set for the data interface. The phase margin is measured, starting with the delay value set for the clock interface. The error rate setting range is from 10^{-3} to 10^{-9}. There are two error rate accuracy, "Fine" and "Coarse". The number of measurement bits of the "Fine" mode is 100 time as many as the number of measurement bits of the "Coarse" mode.

(2) Diagram measurement

In the two-dimensional coordinate system (the X-axis phases represents and the Y-axis represents threshold voltages), the points where the error rate is as specified are plotted. Select the number of the points of the same error rate from 8, 16, 32, and 64.



(1) Margin measurement **(2) Diagram measurement**

Fig. 6-4 Eye margin measurements

Note

If the input data signal level is set to ECL, PECL, TTL on the 'Setup: Data I/F' panel, only the phase margin can be measured.

Note

In case of high input amplitude, the result of eye margin and eye diagram at the Threshold direction may be higher than real input amplitude.

6.4.2 Setting margin measurement conditions

This section describes how to make the settings necessary for margin measurement.

1. Select "Repeat" as the pattern input mode.

   1-1. To open the Pattern dialog box, press the Setup button of the ED unit on the 'Setup: Pattern' panel.

   1-2. Select "Repeat" from the Pattern Input drop-down list box.

2. Open the 'Text Menu: Measurement' panel.

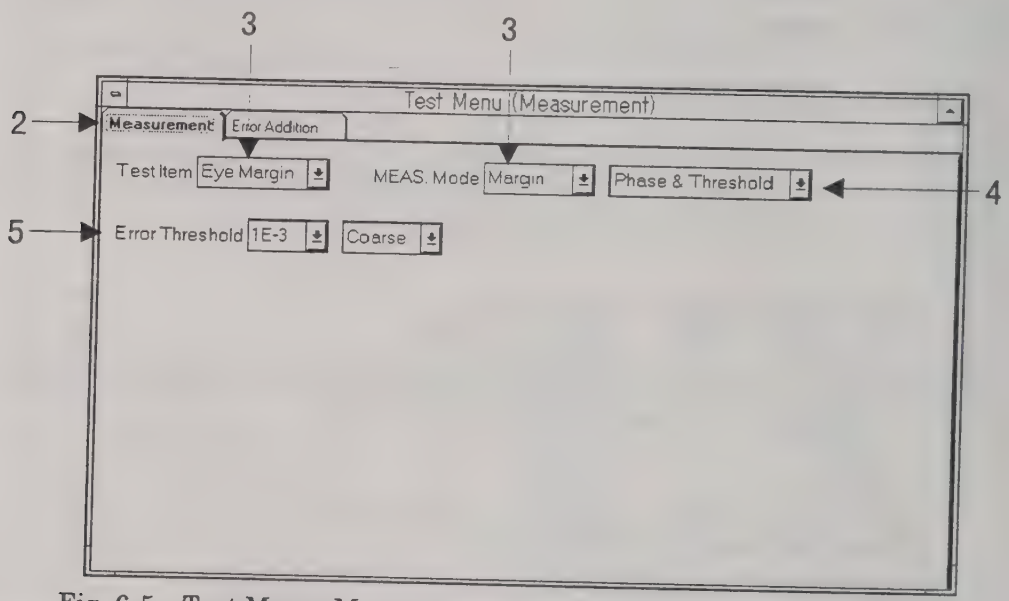


Fig. 6-5 Test Menu: Measurement panel (during margin measurement)

3. Select "Eye Margin" from the Test Item drop-down list box. Select "Margin" from the MEAS. Mode drop-down list box.

4. Select a subject of measurement from the MEAS. Mode drop-down list box.

Threshold	Measures the threshold voltage margin.
Phase	Measures the phase margin.
Threshold & Phase	Measures threshold and phase margins at the same time.

5. Select an error rate and error rate accuracy from the Error Threshold drop-down list box. Relationships between the accuracies shown in the drop-down list box, and the error rates are as follows:

Table 6-1 Error rates and accuracy

	Coarse	Fine
1E-3	$1/10^3$	$100/10^5$
1E-4	$1/10^4$	$100/10^6$
1E-5	$1/10^5$	$100/10^7$
1E-6	$1/10^6$	$100/10^8$
1E-7	$1/10^7$	$100/10^9$
1E-8	$1/10^8$	$100/10^{10}$
1E-9	$1/10^9$	$100/10^{11}$
1E-10	$1/10^{10}$	$100/10^{12}$
1E-11	$1/10^{11}$	$100/10^{13}$
1E-12	$1/10^{12}$	$100/10^{14}$

Note

The lower error rate is selected, the more time will take. For example Threshold & Phase measurement will need a few days when 1E-12 and Fine is selected.

6. This completes the setting. For how to start measurement, see Section "6.4.3 Performing margin measurement".

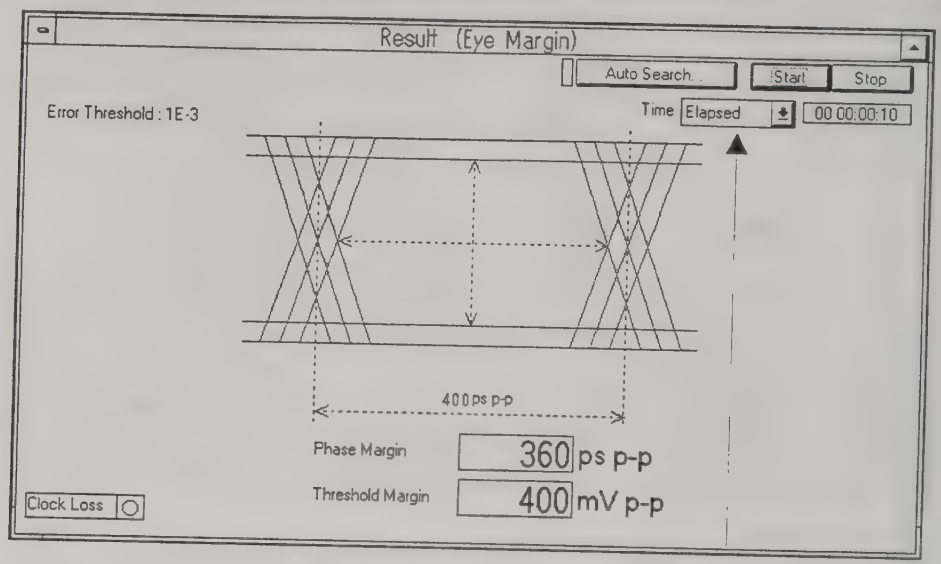
Note

If you change the setting made on the 'Test Menu: Measurement' panel after completion of measurement, then the result of the last measurement will be cleared.

6.4.3 Performing margin measurement

The Result subwindow is used to start, stop, or monitor measurement. Open the Result subwindow after making sure that 'Test Menu: Measurement' panel is set as follows:

- "Eye Margin" has been selected from the Test Item drop-down list box.
- "Margin" has been selected from the MEAS. Mode drop-down list box.



2

Fig. 6-6 Result subwindow (during margin measurement)

Pressing the Start button at the upper-right corner of the subwindow will start measurement. Pressing the Stop button will stop measurement. During measurement, the gauge is displayed to indicate that measurement is being performed. At the lower-left corner of the subwindow is the Clock Loss monitor lamp which lights up when clock loss occurs.

■ The procedure for displaying the measurement result is as follows:

1. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time.
Start	Displays the measurement start time.
Date & Time	Displays the current date and time.

Note

If error exceeds the specified error rate with the starting threshold voltage and phase, eye margin measurement results in failure.

Note

In case of high input amplitude, the result of eye margin at the Threshold direction may be higher than real input amplitude.

6.4.4 Setting diagram measurement conditions

This section describes how to make the settings necessary for diagram measurement.

1. Select "Repeat" as the pattern input mode.

   1-1. To open the Pattern dialog box, press the Setup button of the ED unit on the 'Setup: Pattern' panel.

   1-2. Select Repeat from the Pattern Input drop-down list box.

2. Open the 'Text Menu: Measurement' panel.

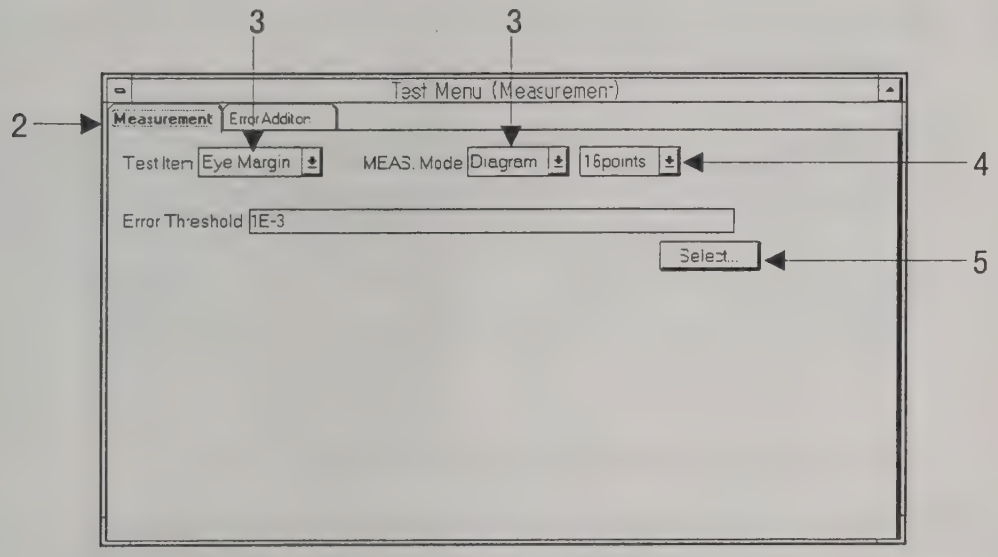


Fig. 6-7 Test Menu: Measurement panel (during diagram measurement)

3. Select Eye Margin from the Test Item drop-down list box. Select "Diagram" from the MEAS. Mode drop-down list box.

4. Select the number of the points (8, 16, 32, or 64) from the drop-down list box at the right of the MEAS. Mode drop-down list box.

5. Select an error rate. Press the Select button to open the Threshold Select dialog box. After checking the error rate to be plotted in the two-dimensional space shown in Fig.6-4 (2), press the OK button to close the dialog box.

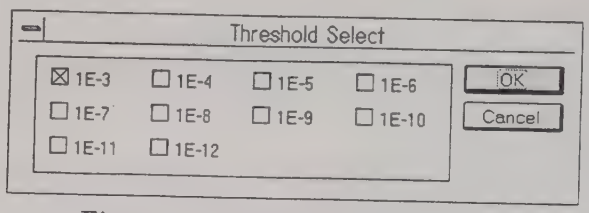


Fig. 6-8 Threshold Select dialog box

6. This completes the setting. For how to start measurement, see Section 6.4.5, "Performing dialog measurement".

Note

If you change the setting made on the 'Test Menu: Measurement' panel after completion of measurement, then the result of the last measurement will be cleared.

6.4.5 Performing dialog Measurement

The Result subwindow is used to start, stop, or monitor measurement. Open the Result subwindow after making sure that 'Test Menu: Measurement' panel is set as follows:

- Eye Margin has been selected from the Test Item drop-down list box.
- Diagram has been selected from the MEAS. Mode drop-down list box.

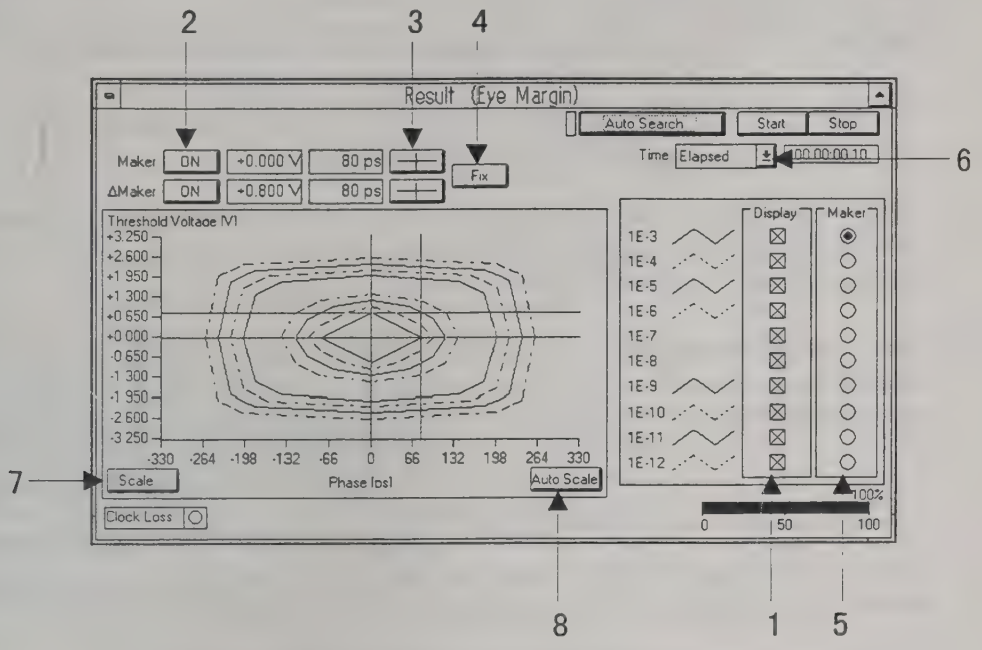


Fig. 6-9 Result window (during margin measurement)

Pressing the Start button at the upper-right corner of the subwindow will start measurement. Pressing the Stop button will stop measurement. During measurement, the gauge is displayed to indicate that measurement is being performed. At the lower-left corner of the subwindow is the Clock Loss monitor lamp which lights up when clock loss occurs.

Note

If error exceeds the specified error rate with the starting threshold voltage and phase, eye margin measurement results in failure.

The Result subwindow allows you to change the scale of display, and to display a marker. In addition, you can switch on or off diagrams display by specifying the corresponding error rates.

Note

In case of high input amplitude, the result of eye diagram at Threshold direction may be higher than real input amplitude.

■ The procedure for displaying the measurement result is as follows:

1. Specify the desired error rate for the diagram. Tick the corresponding error rate check button in the Display group box.

2. Turn on or off the marker. Press the button on the right of Marker or ΔMarker. Applications of the two marker are as follows:

Marker	A reference marker which indicates the absolute values of the threshold and phase at the marker position.
ΔMarker	A relative marker which indicates the distances of the threshold and phase from the reference marker.

3. Bring a marker into focus. Pressing the red cross button will bring the reference marker into focus. Pressing the blue cross button will bring the relative marker into focus. The marker in focus can be moved with arrow keys or rotary encoder.

4. Specify a marker movement mode. Press the button (see fig.6-9). The selected mode will appear on the button. There are the following two marker movement modes:

Fix	Moves the marker along one of the plotted diagrams.
Free	Moves the marker within the display area irrespective of the measurement result.

5. When you have selected "Fix", select the diagram on which the marker is to be located. Select it by pressing the corresponding option switch in the Marker group box.

6. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time.
Start	Displays the measurement start time.
Date & Time	Displays the current date and time.

7. Set the scales of the threshold axis and the phase axis respectively. Press the Scale button. The Scale dialog box will open.

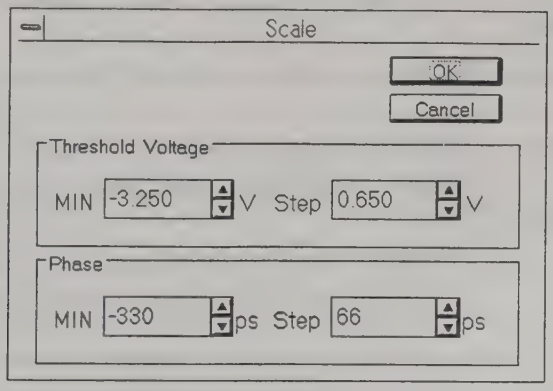


Fig. 6-10 Scale dialog box

7-1. Enter the minimum values and graduations of the threshold and phase. The setting ranges are as follows:

Setting item	Setting range
MIN (Threshold)	-4.000 to +3.990 V
Step (Threshold)	0.001 to 0.800 V
MIN (Phase)	-1000 to +980 ps
Step (Phase)	2 to 200 ps

7-2. Press the OK button to define the setting made above.

8. To adjust the scale automatically so that the entire measurement result is included in the display area, press the Auto Scale button.

■ Moving Markers

To move markers, use the arrow keys or rotary encoder at the front of the main frame. Marker movements depend on the selected movement mode. Functions of the marker movement keys are described below.

Fix mode	
Turing clockwise	Move the marker clockwise along the measurement points.
Turning counterclockwise	Move the marker counter clockwise along the measurement points.
↑, →key	Move the marker clockwise along the measurement points.
↓, ←key	Move the marker counterclockwise along the measurement points.

Freemode	
Turning clockwise	Moves the marker to the right when O is displayed on the vertical bar of the marker. Moves the marker up when O is displayed on the horizontal bar of the marker.
Turning counterclockwise	Moves the marker to the left when O is displayed on the vertical bar of the marker. Moves the marker down when O is displayed on the horizontal bar of the marker.
↓key	Move the marker down.
↑key	Move the marker up.
←key	Move the marker to the left.
→key	Moves the marker to the right.
Shift + Enter	Change the O position.
Clicking the edge of the Markers	Change the O position.

6.4.6 Printing the measurement result

This section describes how to print out the result of the last measurement.

1. Select "Print" from File menu of the parent window after the measurement. The Print dialog box will be opened.

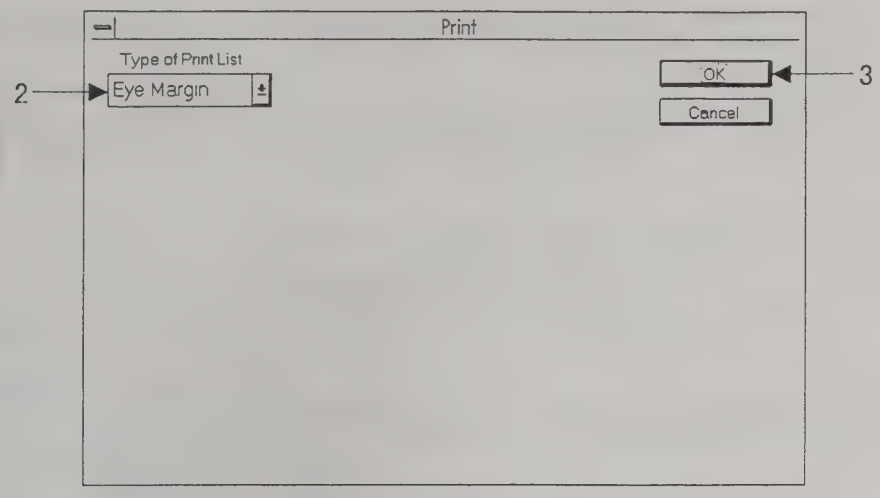


Fig. 6-11 Print dialog box

2. Select "Eye Margin" from the Type of Print List drop-down list box.

3. If you press the OK button, printing starts.

In the 'Setup: Utility' panel you can set three setting items, the Logic and the DC Impedance and the Meas. Restart. This section describes meanings of those setting and setting procedures.

1. Logic

You can decide the voltage level of bit "1" high or low by selecting from the Logic drop-down list box.

Mark High : "1" corresponds to high level output and "0" corresponds to low level output.
Mark Low : "1" corresponds to low level output and "0" corresponds to high level output.

Table 6-2 Voltage level of "1" according to the Logic selection on the 'Setup: Utility' panel and Setup: Pattern panel.

		PRGM Mark		PRBS Mark	
		High	Low	High	Low
PRGM, Zero-Sub Logic	POS	High	Low		
	NEG	Low	High		
PRBS Mark Ratio	1/2,1/4,1/8,0/8			Low	High
	1/2INVT,3/4,7/8,8/8			High	Low

2. DC Impedance

This setting decides the impedance of the clock and data outputs in DC area. You can select 0Ω or 50Ω. If 0Ω is selected, the signal from the PPG has proper offset without fluctuations even though the load does not have 50Ω DC impedance owing to AC connection and so on. Appositely, if the DUT is designed on the assumption that it is driven under 50Ω in DC area, set DC impedance of the PPG to 50Ω to operate the DUT in normal condition.

3. MEAS. Restart

This setting decides whether ED should restart measuring when clock delay (on 'Setup: Clock' panel) or threshold (on 'Setup: Data' panel) are changed.
If 'ON' is selected ED will restart measuring immediately after changing those settings.

- **PPG side setting**

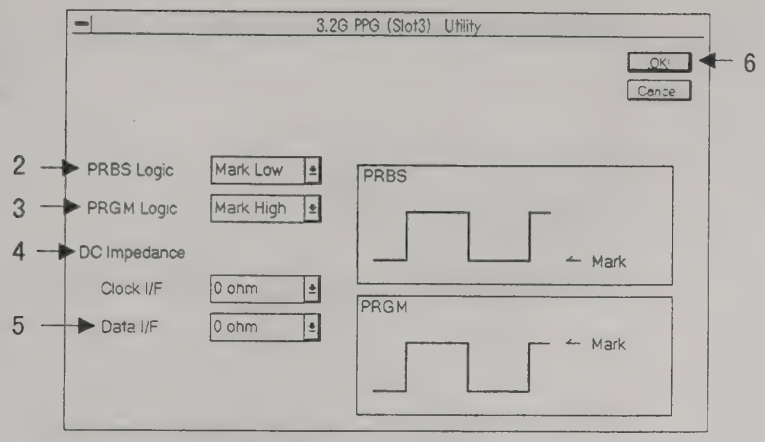


Fig. 6-12 3.2G PPG Utility dialog box

1. Open the 'Setup: Utility' panel and press the Setup button in the PPG group box. The 3.2G PPG Utility dialog box will be opened.

2. Set PRBS pattern logic by selecting from the PRBS Logic drop-down list box.

3. Set PRGM pattern logic by selecting from the PRGM Logic drop-down list box.

4. Set DC impedance of clock interface by selecting from the Clock I/F drop-down list box.

   Note

   You cannot select "50 ohm" when "VAR" is not selected from the Level drop-down list box on the 'Setup: Clock' panel.

5. Set DC impedance of data interface by selecting from the Data I/F drop-down list box.

   Note

   You cannot select "50 ohm" when "VAR" is not selected from the Level drop-down list box on the 'Setup: Data' panel.

6. Now the setting is completed. To enable the change, press the OK button.

- **ED side setting**

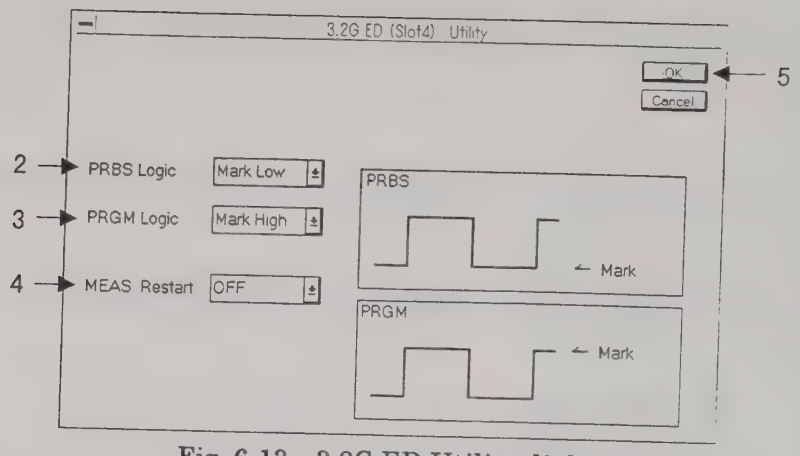


Fig. 6-13 3.2G ED Utility dialog box

1. Open the 'Setup: Utility' panel and press the Setup button in the ED group box. The 3.2G ED Utility dialog box will be opened.

2. Set PRBS pattern logic by selecting from the PRBS Logic drop-down list box.

3. Set PRGM pattern logic by selecting from the PRGM Logic drop-down list box.

4. Select ON or OFF from the MEAS. Restart drop-down list box.

5. Now the setting is completed. To enable the change, press the OK button.

CHAPTER 7 APPLICABLE MEASUREMENT

This section shows a measuring example that tests DEF IC with ECL interface.

(1) Connection

1. Fig. 7-1 shows the connection of the front panel.

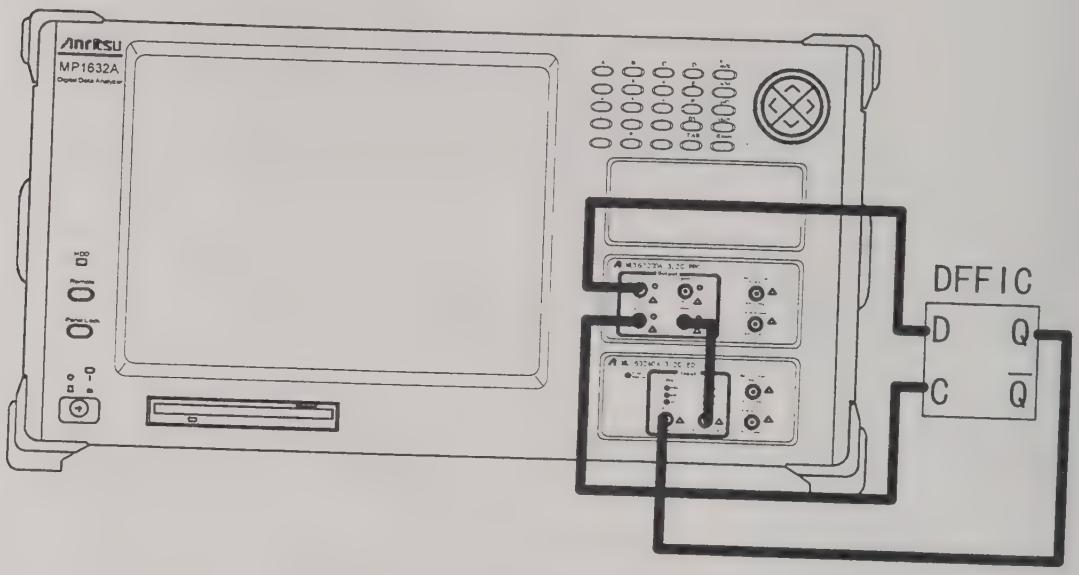


Fig. 7-1 Front panel connection

2. Fig. 7-2 shows the connection of the rear panel.

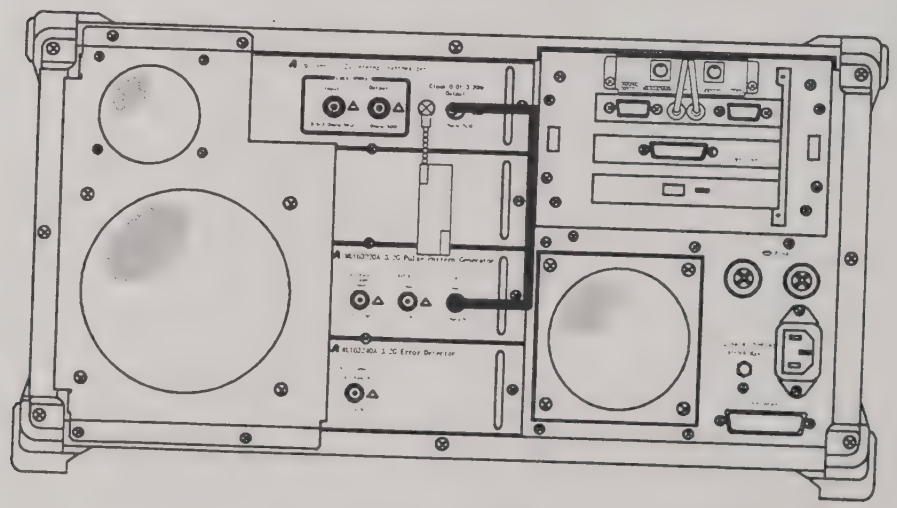


Fig. 7-2 Rear panel connection

(2) **Measurement condition setting**

1. Make settings on each panel of the Setup subwindow same condition as Table7-1

Table 7-1 Setting on the Setup subwindow

Panel	Setting item	Value
Setup	Pattern Common Setting	ON (To set pattern commonly to PPG and ED)
Frequency	Reference	INT
	Frequency	3200000 kHz*
Clock I/F (PPG)	Output	ON
	Delay	0 ps
	Level	ECL
Clock I/F (ED)	Polarity	POS
	Termination	-2 V
	Delay	0 ps
Data I/F (PPG)	Output	ON
	Level	ECL
Data I/F (ED)	Level	ECL
Pattern	Pattern	PRBS15
	Mark Ratio	1/2
	Auto Sync	ON
	Internal Threshold	ON

* For setting procedure, refer to the "MP1632A 3.2G Digital Data Analyzer operating manual".

2. Make settings on the Measurement panel of the Test Menu subwindow same condition as Table7-2

Table 7-2 Setting on the Test Menu subwindow

Panel	Setting item	Value
Measurement	Test Item	Error/Alarm
	MEAS. Mode	Repeat
	Meas. Time	00:00:00:10 (10 seconds)

If you want to measure EI, %EFI, or error performance, measuring condition setting is required. For detail of the procedure, refer to "5.7.2 Setting measuring conditions".

3. To display error count and alarms, open the ALL panel of the Result subwindow, and make setting same condition as Table 7-3.

Table 7-3 Setting on the Result subwindow

Panel	Setting item	Value
ALL	Display	Current
	time display mode	Elapsed

Now, press the Start button to start measuring.
If the phase relation between Data and Clock seems to slip out, press the Auto Search button. The Auto Search dialog will open. Make settings same condition as Table 7-4.

Table 7-4 Setting on the Auto Search dialog box

	Setting item	Value
Auto Search	Mode	Phase
	PRBS Pattern Search	OFF

To start auto search, press the Start button on the Auto Search dialog box.

CHAPTER 8 PERFORMANCE TEST

Performance tests are used to check the main function of the MU163220A 3.2G Pulse Pattern Generator (hereafter called "the PPG unit") and MU163240A 3.2G Error Detector (hereafter called "the ED unit"), and verify that they meets specifications. This chapter explain how to execute the performance tests. The test items of the performance tests are described bellow.

Tests for the PPG unit

- Trigger output interface
- Clock output interface
- Data output interface
- Burst trigger output interface

Test for the ED unit

- Trigger output interface
- Clock counter

To test other functions, use self-test software. The self-test tests systematically as combination of internal synthesizer option and pulse pattern generator and error detector. For detail of the self-diagnosis, refer to "CHAPTER 9 SELF-TEST"

The performance tests requires a sampling oscilloscope and a frequency counter and a clock generator. Required performance characteristics of each equipment is described bellow.

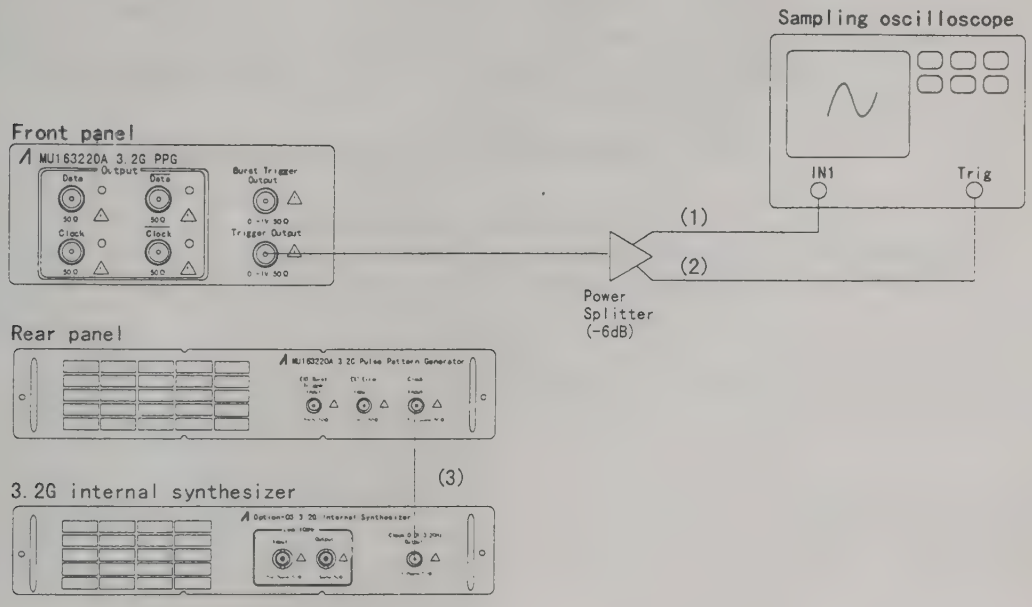
(Sampling oscilloscope)
Use an equipment that covers frequency band more than 20 GHz.

(Frequency counter)
Use an equipment whose range is from 10 kHz to 3.2 GHz, resolution is less than 1 kHz.

(Clock generator)
Use an equipment whose output level is +4 to +10 dBm/50Ω, frequency range is from 50 MHz to 3.2 GHz, frequency accuracy is ±10 ppm or less. OPT03 3.2G Internal synthesizer, the option of MP1632A is suitable.

8.2.1 Trigger output interface

This section describes how to test the waveform of trigger signal from the PPG unit with the sampling oscilloscope. Fig. 8-1 shows how to connect each equipment.



(1) Connect the Trigger Output to the signal input of the sampling oscilloscope through a power splitter.
(2) Connect the Trigger Output to the trigger input of the sampling oscilloscope through a power splitter.
(3) Connect the clock output of the internal synthesizer option to the Clock Input.

Fig. 8-1 Connection for trigger output test

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

4. To display waveform, connect all connectors according to Fig. 8-1. Confirm that the level of the waveform is in the range according to Fig. 8-2.

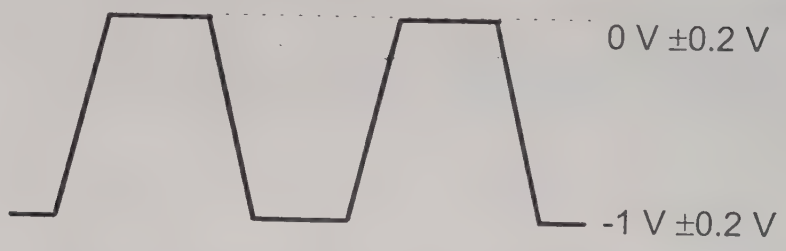


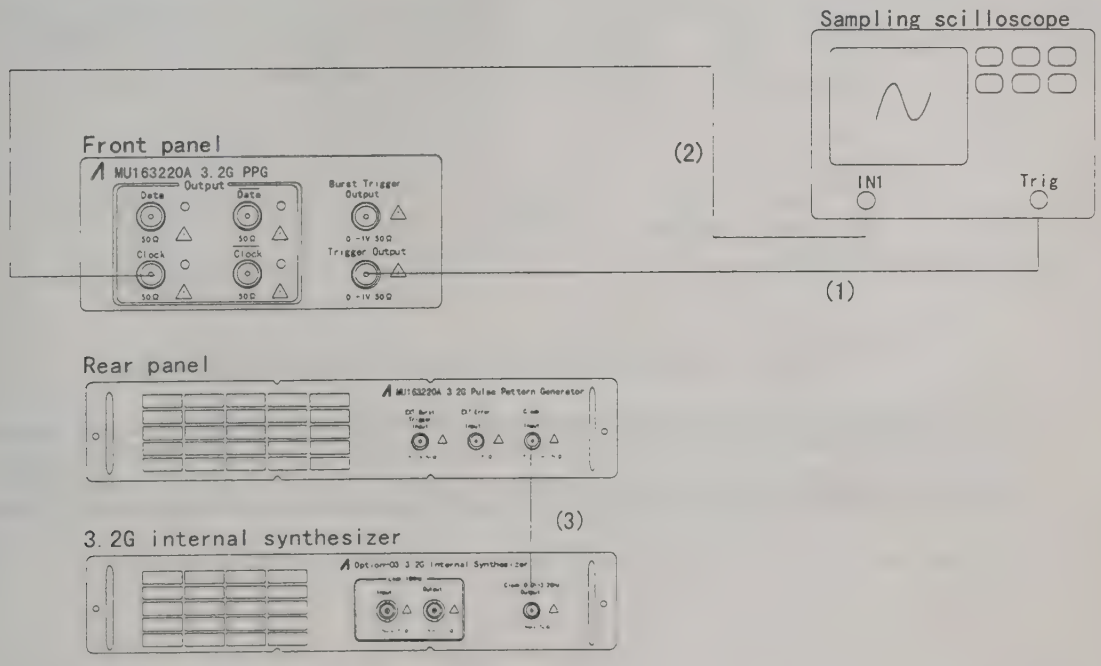
Fig. 8-2 Specifications of Trigger output waveform

8.2.2 Clock output interface

This section describes how to test the waveform of clock from the PPG unit with the sampling oscilloscope. Fig. 8-3 shows how to connect each equipment.

- Specification

Amplitude		0.5 to 2.0 V_{p-p}/10 mV step
		0.5 to 4.0 V_{p-p}/10 mV step (Equipped with OPT02)
	Setting error	Larger of bellow two values or less
		±15% for the set value
		±0.1 V
	Uncertainty	±9.2 mV
	Guard band	1.00
Offset		+2.000 to -3.500 V/5 mV step (Voh)
		+4.250 to -3.500 V/5 mV step (Voh)(Equipped with OPT02)
	Setting error	Larger of bellow three values pr less
		±15% for the set value
		±0.1 V
		or ±15% of the amplitude
	Uncertainty	±9.2 mV
	Guard band	1.00



(1) Connect the Trigger Output to the trigger input of the sampling oscilloscope.
(2) Connect Clock or $\overline{\text{Clock}}$ Output to the signal input of the sampling oscilloscope.
(3) Connect the clock output of the internal synthesizer option to the Clock Input.

Fig. 8-3 Connection for clock output test

(1) ECL level signal

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Clock and $\overline{\text{Clock}}$ output. Select "ECL" from each Level drop-down list box on the 'Setup: Clock I/F' panel of the PPG unit

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-3. Confirm that the level of both waveform is in the range according to Fig. 8-4 and rise/fall time is 80 ps or less.

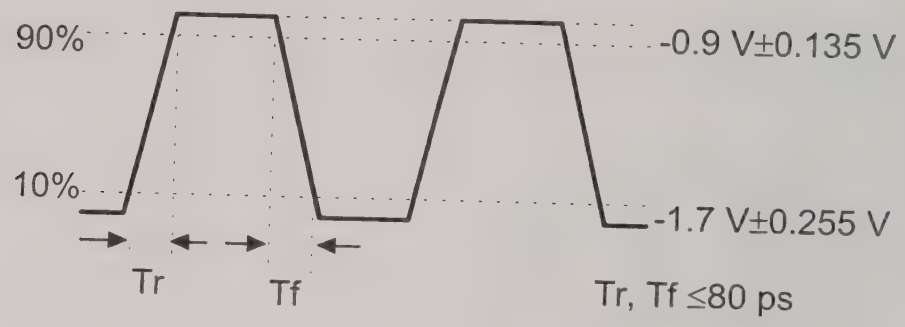


Fig. 8-4 Specifications of clock output waveform (ECL)

Note

If MU163220A mounts OPT02, confirm that the rise/fall time is as following.

Tr, Tf ≤120 ps

(2) VAR level signal (Part 1)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Clock and $\overline{\text{Clock}}$ output. Make settings on the 'Setup: Clock I/F' panel of the PPG unit same condition as described bellow.

   - Delay spin box : Enter -1.0 ns.
   - Offset spin box : Enter -3.000
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-3. Confirm that the level of both waveform is in the range shown as Fig. 8-5 and rise/fall time is 80 ps or less.

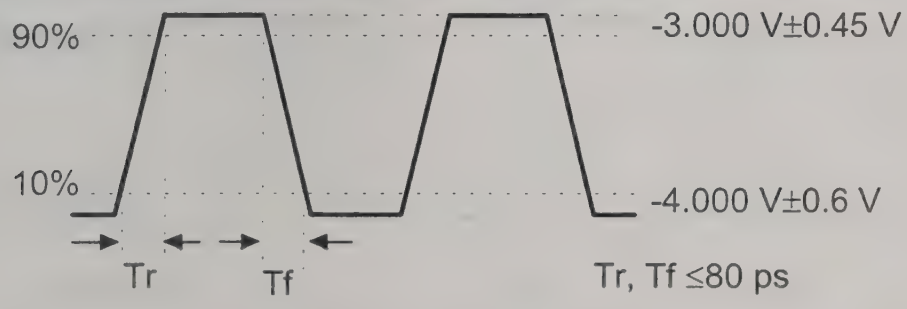


Fig. 8-5 Specifications of clock output waveform (VAR part1)

Note

If MU163220A mounts OPT02, confirm that the rise/fall time is as following.

Tr, Tf ≤120 ps

(3) VAR level signal (Part 2)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Clock and $\overline{\text{Clock}}$ output. Make settings on the 'Setup:Clock I/F' panel of the PPG unit same condition as described bellow.
   - Delay spin box : Enter +1.0 ns.
   - Offset spin box : Enter +2.000
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-3. Confirm that the level of both waveform is in the range shown as Fig. 8-6 and rise/fall time is 80 ps or less.

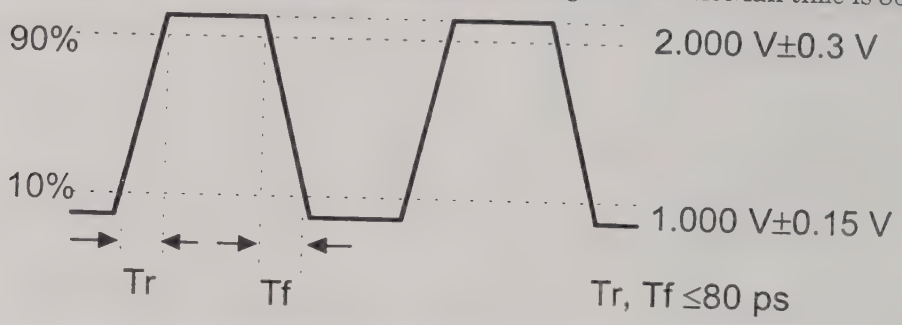


Fig. 8-6 Specifications of clock output waveform (VAR part2)

Note

If MU163220A mounts OPT02 , confirm that the rise/fall time is as following.

Tr, Tf≤120 ps

(4) VAR level signal (Part 3)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Clock and $\overline{\text{Clock}}$ output. Make settings on the 'Setup: Clock I/F' panel of the PPG unit same condition as described bellow.
   - Delay spin box : Enter +1.0 ns.
   - Offset spin box : Enter +4.250
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-3. Confirm that the level of both waveform is in the range shown as Fig. 8-7 and rise/fall time is 120 ps or less.

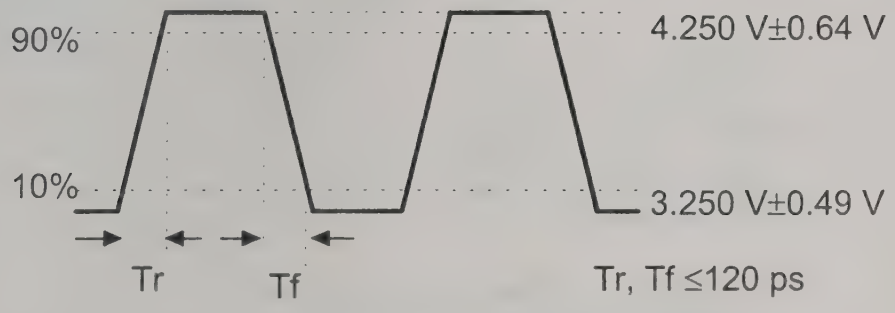


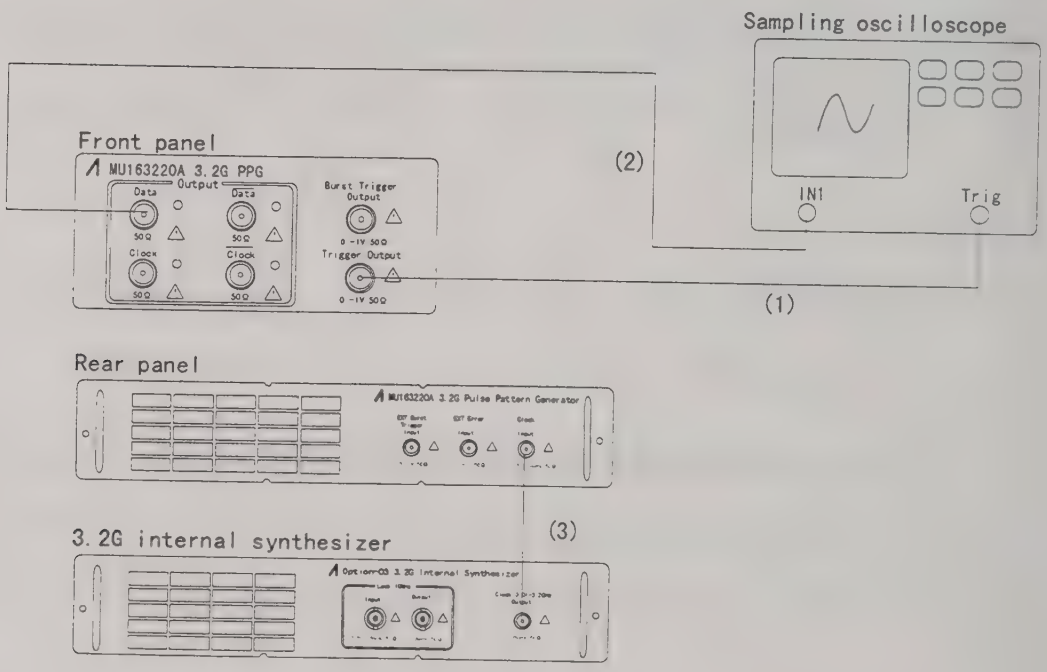
Fig. 8-7 Specifications of clock output waveform (VAR part3)

8.2.3 Data output interface

This section explains how to test the waveform of data signal from the PPG unit with the sampling oscilloscope. Fig. 8-8 shows how to connect each equipment.

- Specification

Amplitude		0.5 to 2.0 V_{p-p}/10 mV step
		0.5 to 4.0 V_{p-p}/10 mV step (Equipped with OPT01)
	Setting error	Larger of bellow two values or less
		±15% for the set value
		±0.1 V
	Uncertainty	±9.2 mV
	Guard band	1.00
Offset		+2.000 to -3.500 V/5 mV step (Voh)
		+4.250 to -3.500 V/5 mV step (Voh)(Equipped with OPT01)
	Setting error	Larger of bellow three values pr less
		±15% for the set value
		±0.1 V
		or ±15% of the amplitude
	Uncertainty	±9.2 mV
	Guard band	1.00



(1) Connect the Trigger Output to the trigger input of the sampling oscilloscope.
(2) Connect Data or $\overline{\text{Data}}$ Output to the signal input of the sampling oscilloscope.
(3) Connect the clock output of the internal synthesizer option to the Clock Input.

Fig. 8-8 Connection for data output test

(1) ECL level signal

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Data and $\overline{\text{Data}}$ output. Select "ECL" from each Level drop-down list box on the 'Setup: Data I/F' panel of PPG unit

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-8. Confirm that the level of both waveform is in the range shown as Fig. 8-9 and rise/fall time is 80 ps or less.

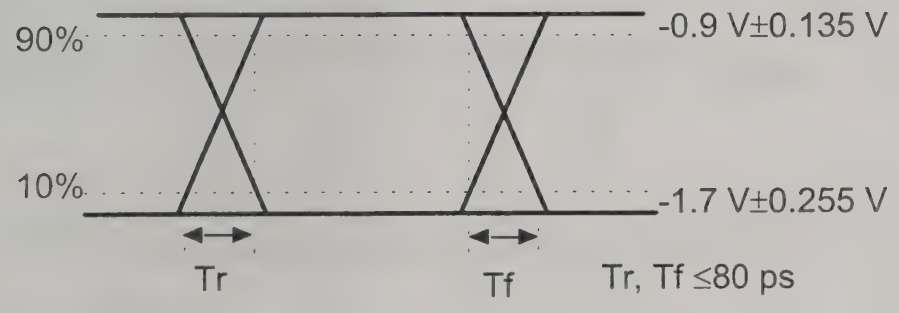


Fig. 8-9 Specifications of data output waveform (ECL)

Note

If MU163220A mounts OPT02, confirm that the rise/fall time is as following.

Tr, Tf ≤120 ps

(2) VAR level signal (Part 1)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Data and $\overline{\text{Data}}$ output. Make settings on the 'Setup: Data I/F' panel of PPG unit same condition as described bellow.
   - Offset spin box : Enter -3.000
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-8. Confirm that the level of both waveform is in the range shown as Fig. 8-10 and rise/fall time is 80 ps or less.

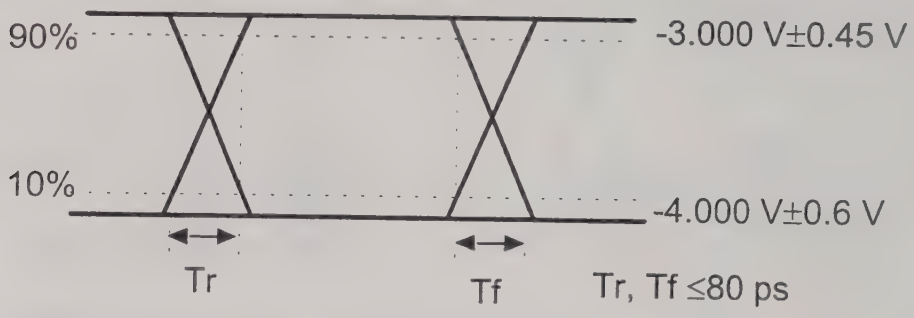


Fig. 8-10 Specifications of data output waveform (VAR part1)

Note

If MU163220A mounts OPT02, confirm that the rise/fall time is as following.

Tr, Tf ≤120 ps

(3) VAR level signal (Part 2)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Data and $\overline{\text{Data}}$ output. Make settings on the 'Setup: Data I/F' panel of PPG unit same condition as described bellow.
   - Offset spin box : Enter +2.000
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-8. Confirm that the level of both waveform is in the range shown as Fig. 8-11 and rise/fall time is 80 ps or less.

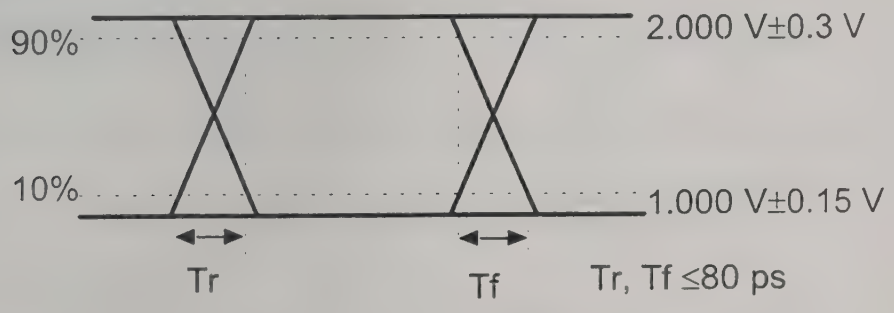


Fig. 8-11 Specifications of data output waveform (VAR part2)

Note

If MU163220A mounts OPT02, confirm that the rise/fall time is as following.

Tr, Tf ≤120 ps

(4) VAR level signal (Part 3)

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
4. Set output level of Data and $\overline{\text{Data}}$ output. Make settings on the 'Setup: Data I/F' panel of PPG unit same condition as described bellow.
   - Offset spin box : Enter +4.250
   - Offset drop-down list box : Select "Voh"

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-8. Confirm that the level of both waveform is in the range shown as Fig. 8-12 and rise/fall time is 120 ps or less.

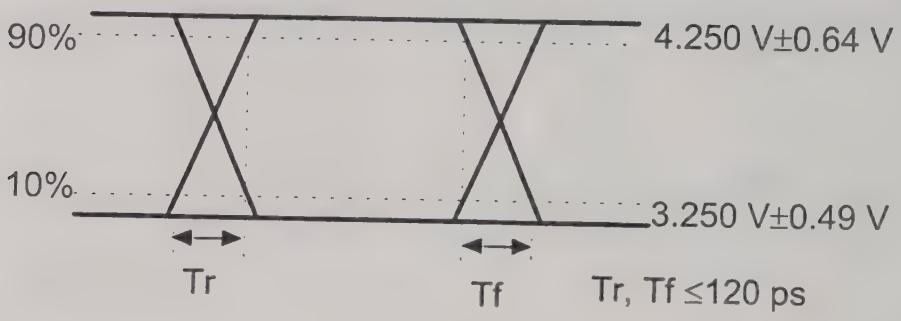
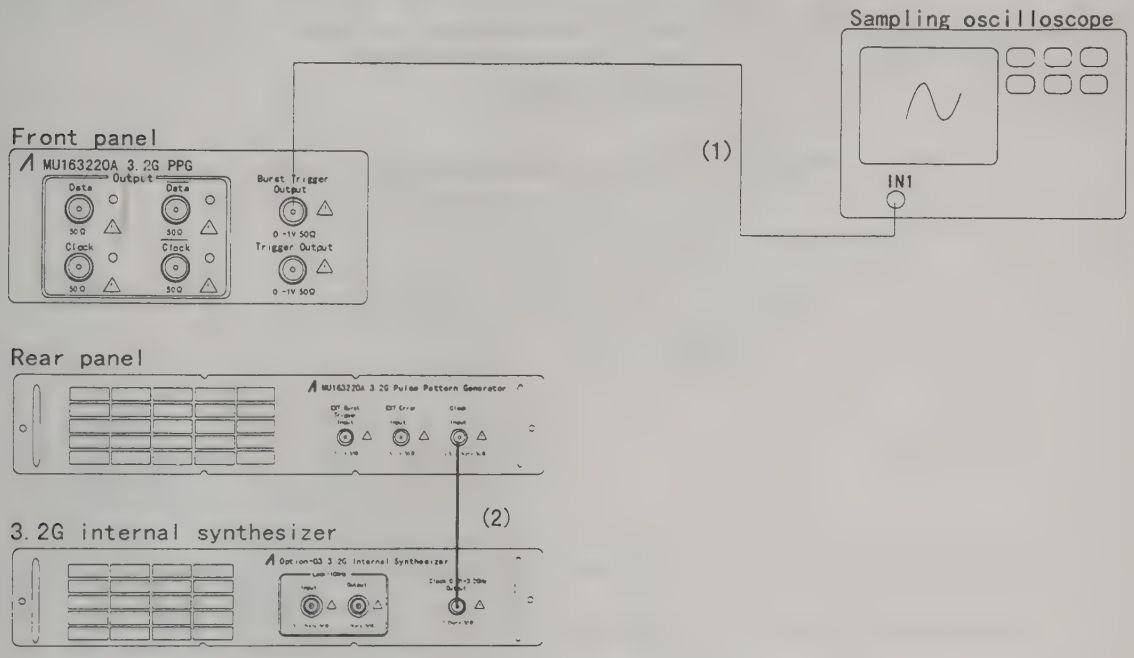


Fig. 8-12 Specifications of data output waveform (VAR part3)

8.2.4 Burst trigger output interface

This section explains how to test the waveform of burst trigger signal from the PPG unit with the sampling oscilloscope. Fig. 8-13 shows how to connect each equipment



(1) Connect the Trigger Output to the trigger input of the sampling oscilloscope.
(2) Connect the clock output of the internal synthesizer option to the Clock Input.

Fig. 8-13 Connection for burst trigger output test

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set output level of Data and $\overline{\text{Data}}$ output. Select "ECL" from each Level drop-down list box on the 'Setup: Data I/F' panel of the PPG unit
4. Set the pattern output mode burst by selecting "Burst" from the Pattern Output drop-down list box on the 'Setup: Pattern' panel of the PPG unit.

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

5. To display waveform, connect all connectors according to Fig. 8-13. Confirm that the level of both waveform is in the range shown as Fig. 8-14

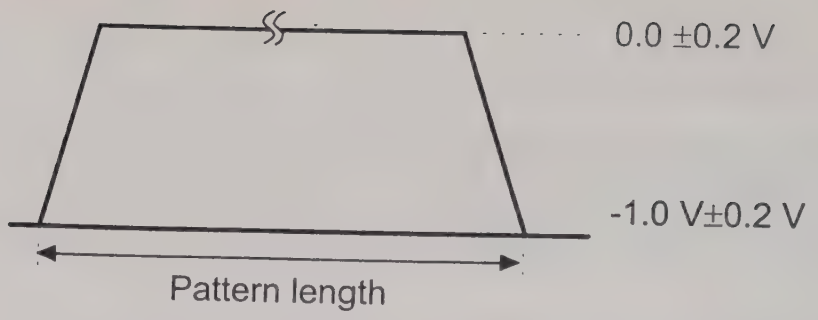
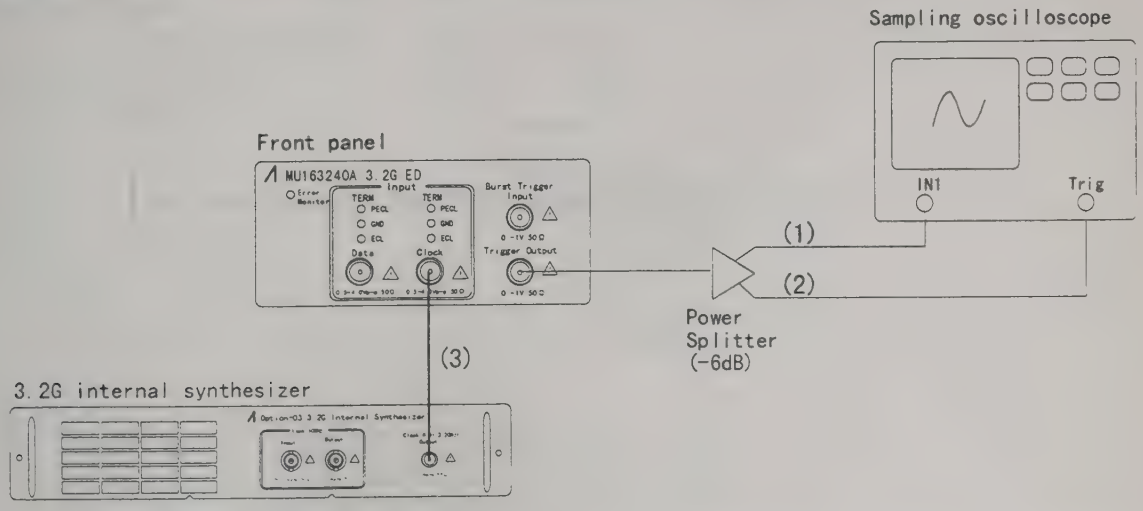


Fig. 8-14 Specifications of burst trigger output waveform

8.3.1 Trigger output interface

This section explains how to test the waveform of trigger signal from the ED unit with the sampling oscilloscope. Fig. 8-15 shows how to connect each equipment.



(1) Connect the Trigger Output to the signal input of the sampling oscilloscope through a power splitter.
(2) Connect the Trigger Output to the trigger input of the sampling oscilloscope through a power splitter.
(3) Connect the clock output of the internal synthesizer option to the Clock Input.

Fig. 8-15 Connection for trigger output test

1. Before starting test, disconnect all connectors.
2. To clear all settings, select Initialize from the File menu.
3. Set clock frequency from the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to the MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.

CAUTION ⚠

Confirm that proper attenuator to input level of the sampling oscilloscope is used before starting test. There is risk of damage the equipment if sampling oscilloscope is connected directly.

4. To display waveform, connect all connectors according to Fig. 8-15. Confirm that the level of the waveform is in the range shown as Fig. 8-16.

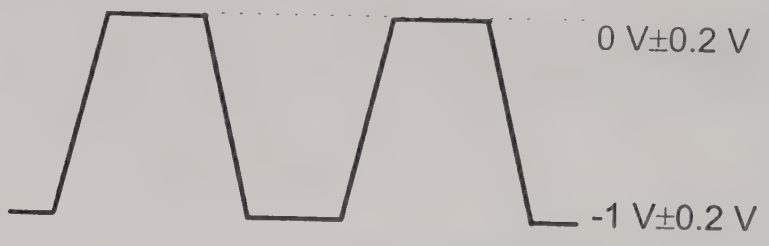


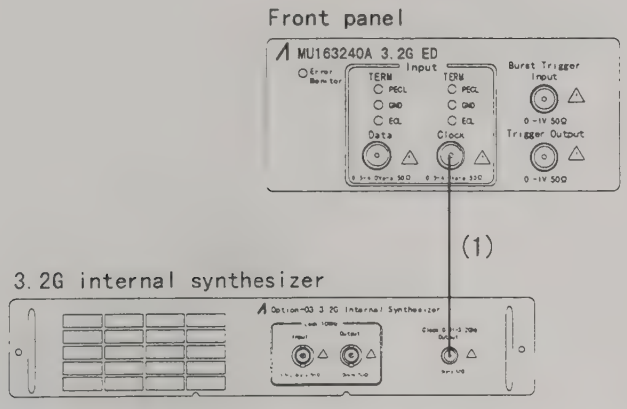
Fig. 8-16 Specifications of Trigger output waveform

8.3.2 Clock counter

This section explains how to test whether the clock counter works normally. Fig. 8-17 shows connections for this test.

- Specification

Frequency accuracy	±10 ppm ±1 kHz
Uncertainty	±2.31 ppm
Guard band	1.00



(1) Connect the clock output of the internal synthesizer to the Clock input.

Fig. 8-17 Connection for clock counter test

1. To clear all settings, select Initialize from the File menu.
2. Set clock frequency of the clock generator 3.2 GHz. In case the internal synthesizer option is used as clock generator, refer to the MP1632A 3.2G Digital Data Analyzer operation manual "6.13 Setting a Frequency". In other case refer to its own operation manual.
3. Open the 'Result: All' panel and start error/alarm measurement there.
4. Confirm that the measured frequency ranges 3.2 GHz ±33 kHz.
5. In a similar way, confirm that the measured frequency ranges 50 MHz ±1500 Hz after set clock frequency from the clock generator 50 MHz.

(Blank)

CHAPTER 9 SELF-TEST

MP1632A Digital Data Analyzer has self-test function to determine whether instruments operate normally. The self-test performs the diagnosis below that do not require peripheral equipment. Hereafter MU163220A 3.2G Pulse Pattern Generator is called "the PPG" and MU163240A 3.2G Error Detector is called "the ED" simply.

1. Clock loss detection and recovery test
   Tests whether the instrument detects clock loss alarm when it occurs, and whether the instrument erroneously detects clock loss alarm when no alarm occurs.

2. SYNC loss detection and recovery test
   Tests whether the instrument detects SYNC loss alarm when it occurs, and whether the instrument erroneously detects SYNC loss alarm when no alarm occurs.

3. Input-output interface test
   Tests whether the data output level of the PPG and data input threshold of the ED are normal.

4. PRBS mark ratio switching test
   Tests whether the PPG outputs the set mark ratio and bit shift of PRBS, whether the ED normally measures the pattern.

5. DC Impedance switching test
   Tests whether the DC impedance switches normally.

6. Frequency accuracy test
   Tests whether the OPT-03 3.2G Internal Synthesizer normally outputs the set frequency and the ED normally measures a frequency.

7. PRBS steps switching test
   Tests whether the PPG outputs PRBS pattern of the set steps, whether the ED normally measures the pattern.

8. PDH/SDH frequency test
   Tests whether OPT-03 3.2G Internal Synthesizer and the ED operate normally at PDH/SDH frequency.

9. Error addition and measurement test
   Tests whether the PPG adds errors and the ED measures them normally.

10. PRBS Synchronous determination test
    Tests whether the synchronous determination circuit of the ED operates normally when pattern type is PRBS.

11. Burst measurement test
    Tests whether the ED measures burst signal from the PPG normally.

12. Zero-Subst Normal Synchronous determination test
    Tests whether the synchronous determination circuit of the ED operates normally when pattern type is Zero-Subst.

13. Maximum length PRGM pattern test
    Tests whether the PPG and the ED operate normally when their pattern type is PRGM whose length is maximum.

14. PRGM logic inversion test
    Tests whether logic inversion operates normally when pattern type is PRGM whose length is maximum.

15. PRGM Frame Synchronous determination test
    Tests whether the synchronous determination circuit of the ED operates normally when pattern type is Zero-Subst and Frame is selected as synchronization method.

16. INS error counter test
    Tests whether the ED detects errors which are added by the PPG as insertion error.

17. OMI error counter test
    Tests whether the ED detects errors which are added by the PPG as omission error.

18. Clock delay test
    Tests whether the clock delay circuit of the PPG and the ED operates normally.

Note

The self-test function is limited for use as follows:

The self-test function is available only when the MU163220A 3.2G Pulse Pattern Generator and the MU163240A 3.2G Error Detector are inserted in the MP1632A Digital Data Analyzer. Those units may be mounted in either of slot 3 and slot 4.

It is not available when the MP1632A Digital Data Analyzer control software is in progress. In this case, be sure to exit the control software before executing the self-test program.

This section describes how to connect signals between units used before executing the self-test function.

The following paragraphs show how to connect signals of each unit.

- Connecting signals of the 3.2G Internal Synthesizer option

Fig. 9-1 shows the rear view of the 3.2G Internal Synthesizer and its connection.

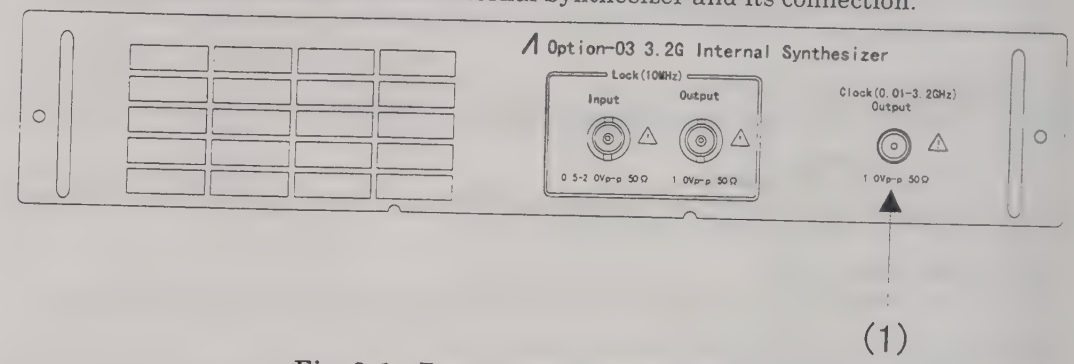


Fig. 9-1 Rear view of internal synthesizer

(1) Clock Output

Connect this Clock Output to the Clock Input on the MU163220A rear panel.

- Connecting signals of the MU163220A 3.2G Pulse Pattern Generator

Fig. 9-2 and Fig. 9-3 show the front and rear view of the MU163220A 3.2G Pulse Pattern Generator and its connection.

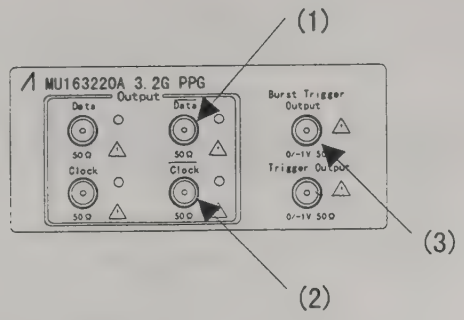


Fig. 9-2 Front view of MP163220A

(1) $\overline{\text{Data}}$ Output

Connect this to the Data Input on the front panel of the MU163240A 3.2G Error Detector.

(2) $\overline{\text{Clock}}$ Output

Connect this to the Clock Input on front panel of the MU163240A 3.2G Error Detector.

(3) Burst Trigger Output

Connect this to the Burst Trigger Input on the front panel of the MU163240A 3.2G Error Detector.

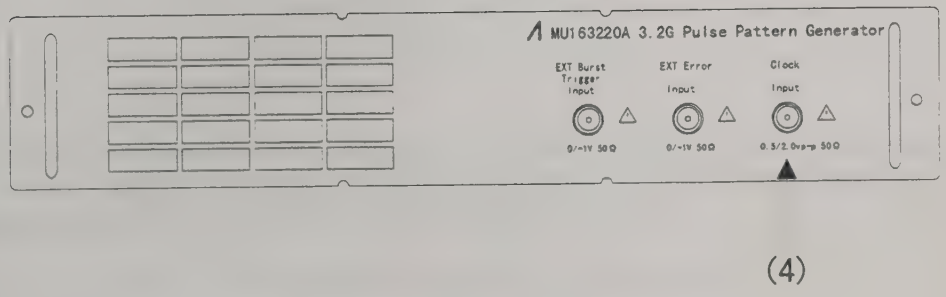


Fig. 9-3 Rear view of MP163220A

(4) Clock Input

Connect this to the Clock Output on the rear panel of the 3.2G internal synthesizer.

- Connecting signals of the MU163240A 3.2G Error Detector

Fig. 9-4 shows the front view of the MU163240A 3.2G Error Detector and its connection.

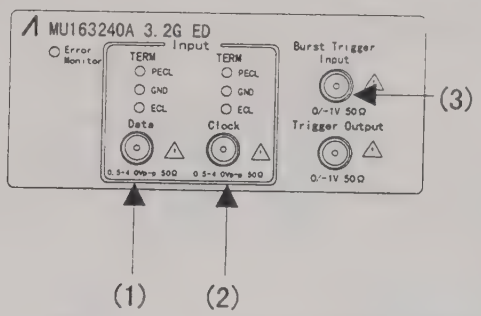


Fig. 9-4 Front view of MP163240A

(1) Data Input

Connect this to the $\overline{\text{Data}}$ Output on the front panel of the MU163220A 3.2G Pulse Pattern Generator.

(2) Clock Input

Connect this to the $\overline{\text{Clock}}$ Output on the front panel of the MU163220A 3.2G Pulse Pattern Generator.

(3) Burst Trigger Input

Connect this to the Burst Trigger Output on the front panel of the MU163220A 3.2G Pulse Pattern Generator.

The self-test consists of the following four types of panels:

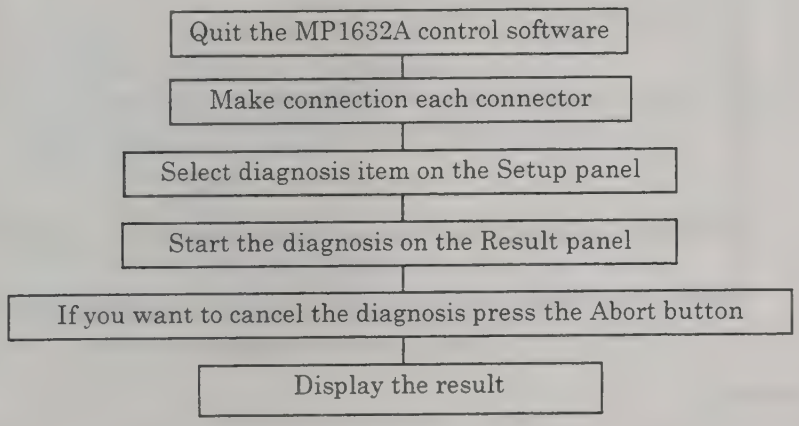
1) System panel
   Displays the current state of the MP1632A.

2) Connection panel
   Displays a connection diagram referenced to connect terminals on the front and rear of each unit depending on the current set state and device state.

3) Setup panel
   Used to select the contents to be executed by the self-test program.

4) Result panel
   Displays the self-test execution result.

The self-test is executed in the procedure below.


Quit the MP1632A control software
Make connection each connector
Select diagnosis item on the Setup panel
Start the diagnosis on the Result panel
If you want to cancel the diagnosis press the Abort button
Display the result

Note

The self-test is not available when the MP1632A control software is in progress.
To execute the self-test, exit the MP1632A control software.

The self-test is registered in the MP1632A Digital Data Analyzer group.

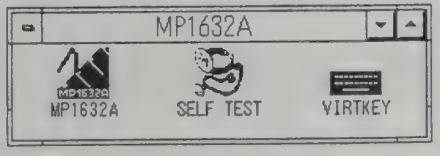


Fig. 9-5 MP1632A Digital Data Analyzer group

The self-test is registered with icon name "SELF TEST". Use this icon to start the self-test. For details on the screen operation and functions, see the subsequent chapters.

This section describes how to operate the self-test screens.

9.4.1 Master window

Fig. 9-6 shows the MP1632A Selftest master window.

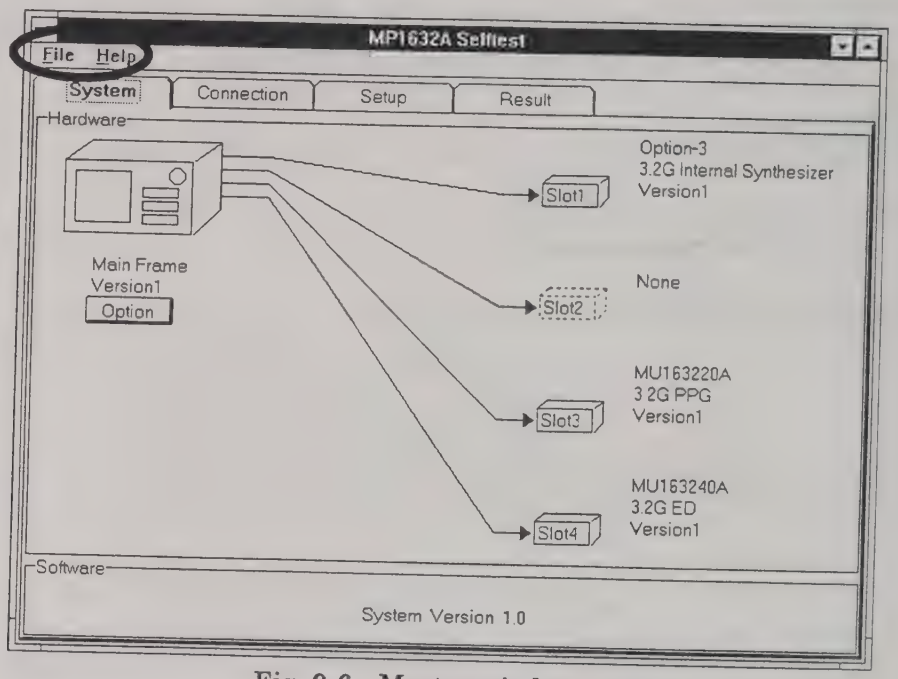


Fig. 9-6 Master window screen

Menu configuration

- File pull-down menu

Save	Saves the self-test result in the text format. Invalid when the result does not exist.
Print	Outputs the self-test result to an external printer. Invalid when the result does not exist.
Printer Setup	Sets an external printer.
Exit	Exits the self-test program.

- Help pull-down menu

About MP1632A Selftest	Displays self-test version information.

9.4.2 System panel

Fig. 9-7 shows the System panel

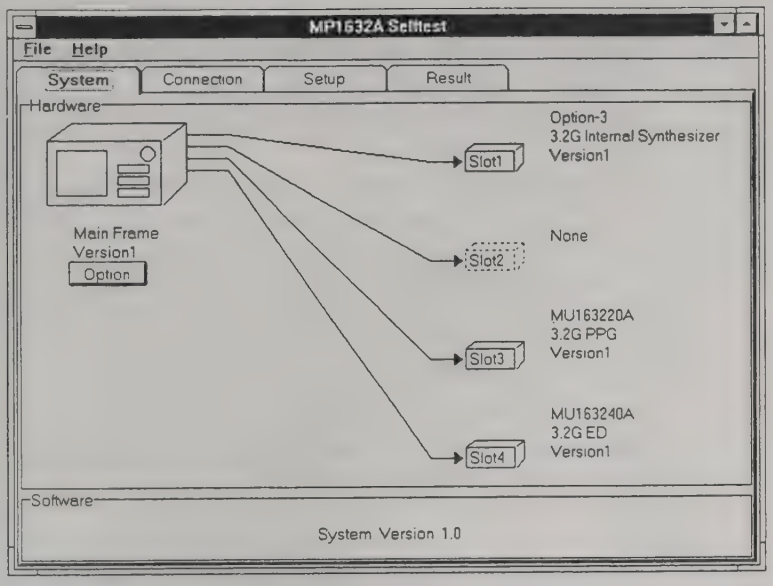


Fig. 9-7 System panel

(1) Main Frame

Displays the supported main fame version, and supported options by pressing the Option button.

(2) Slot1

Displays the name and supported version of main frame option inserted into slot1.

(3) Slot2

Displays the name and supported version of unit inserted into the slot2.

(4) Slot3

Displays the name and supported version of unit inserted into the slot3.

(5) Slot4

Displays the name and supported version of unit inserted into the slot4.

(6) Software Version

Displays the version of the self-test software.

9.4.3 Connection panel

This panel displays connection of each unit. Make connection in accordance with this panel.

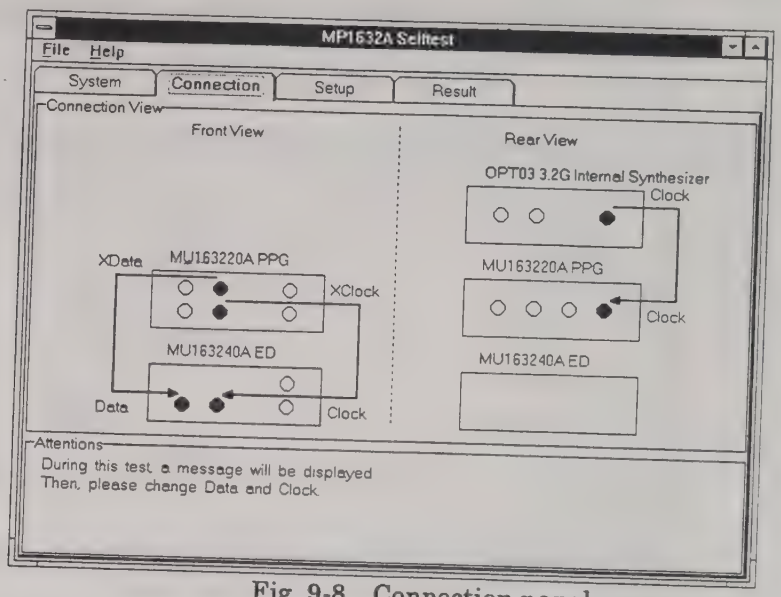


Fig. 9-8 Connection panel

(1) Front View
Display connection of the front panels

(2) Rear View
Display connection of the rear panels

(3) Attentions
Display messages to pay attentions.

9.4.4 Setup panel

This panel permits you to select diagnosis items. Whole diagnosis are classified into five groups. Mark the check boxes of groups you want to perform.

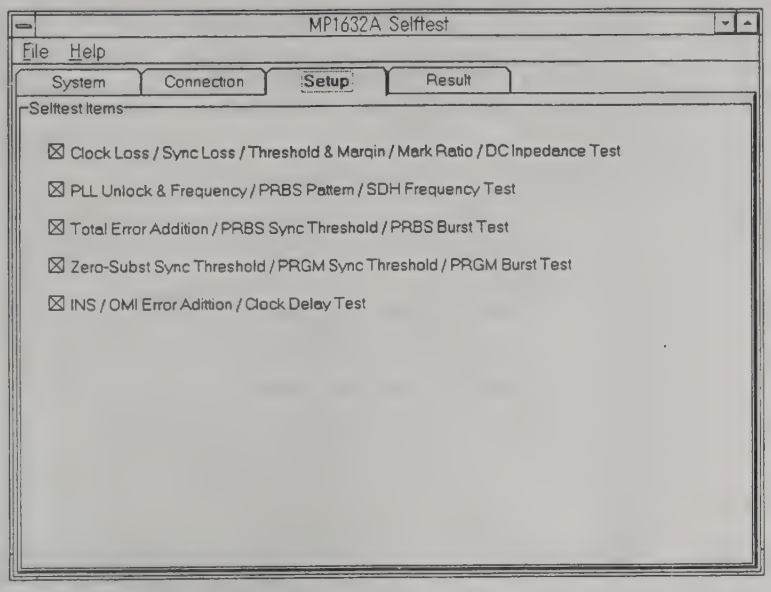

MP1632A Selftest
File Help
System
Connection
Setup
Result
Selftest Items
☒ Clock Loss / Sync Loss / Threshold & Margin / Mark Ratio / DC Inpedance Test
☒ PLL Unlock & Frequency / PRBS Pattern / SDH Frequency Test
☒ Total Error Addition / PRBS Sync Threshold / PRBS Burst Test
☒ Zero-Subst Sync Threshold / PRGM Sync Threshold / PRGM Burst Test
☒ INS / OMI Error Adittion / Clock Delay Test

Fig. 9-9 Setup panel

(1) Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test
This group includes 1, 2, 3, 4, 5 numbered at page 132.

(2) PLL Unlock&Frequency/PRBS Pattern/PDH/SDH Frequency Test
This group includes 6, 7, 8 numbered at page 132.

(3) Total Error Addition/PRBS Sync Threshold/PRBS Burst Test
This group includes 9, 10, 11 numbered at page 132.

(4) Zero-Subst Sync Threshold/PRGM Sync Threshold/PRGM Burst Test
This group includes 12, 13, 14, 15 numbered at page 132 and 131.

(5) INS/OMI Error Addition/Clock Delay Test
This group includes 16, 17, 18 numbered at page 131.

Note

It takes about an hour until all 5 diagnosis are performed.

During diagnosis (1), an exchange of cable connection is required twice. Please follow the display's instruction. The first time is about 2 minutes later and the second is 10 minutes later after starting of the diagnosis.

9.4.5 Result panel

The Result panel displays start date, elapsed time, and results.

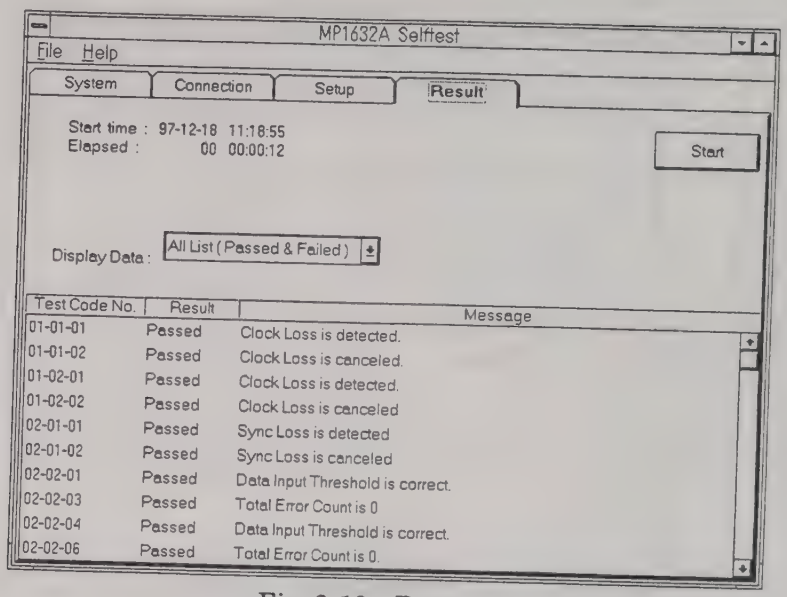

MP1632A Selftest
File Help
System
Connection
Setup
Result
Start time : 97-12-18 11:18:55
Elapsed : 00 00:00:12
Start
Display Data :
All List (Passed & Failed)
Test Code No.
Result
Message
01-01-01 Passed Clock Loss is detected.
01-01-02 Passed Clock Loss is canceled.
01-02-01 Passed Clock Loss is detected.
01-02-02 Passed Clock Loss is canceled
02-01-01 Passed Sync Loss is detected
02-01-02 Passed Sync Loss is canceled
02-02-01 Passed Data Input Threshold is correct.
02-02-03 Passed Total Error Count is 0
02-02-04 Passed Data Input Threshold is correct.
02-02-06 Passed Total Error Count is 0.

Fig. 9-10 Result panel

(1) Start Time
Displays start time.

(2) Elapsed
Displays elapsed time.

(3) Display Data
ALL List Displays all result.
Error List Displays only item which detects something trouble.

(4) Result display area
The results is displayed here. Its format is described below.
Test Code No. Diagnosis item number.
Result Passed or Failed.
Message Content of current diagnosis

(5) Start
Starts the self-test

Note

Don't start any other applications during the self-test is running.

Some diagnosises are depend on if previous diagnosis passes or not. If a diagnosis fails and it disable following diagnosis's, the self-test is canceled immediately in such a case.

9.4.6 Details of self-test

This section describes the details of self-test.

([ ]: Equipped with OPT01)

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (1/6)

Item No.	Diagnosis contents
01-01-01	Tests whether the instrument detects clock loss occurrence when the $\overline{\text{Clock}}$ output is set into "OFF".
01-01-02	Tests whether the instrument detects clock loss recovery when the $\overline{\text{Clock}}$ output is set into "ON".
01-02-01	Tests whether the instrument detects clock loss occurrence when the Clock output is set into "OFF".
01-02-02	Tests whether the instrument detects clock loss recovery when the Clock output is set into "ON".
02-01-01	Tests whether the instrument detects SYNC loss occurrence when the $\overline{\text{Data}}$ output is set into "OFF".
02-01-02	Tests whether the instrument detects SYNC loss recovery when the $\overline{\text{Data}}$ output is set into "ON".
02-02-01	Tests whether the data threshold of the ED ranges -1.300 V ±0.13 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "ECL" and auto search has been performed.
02-02-02	Under 02-02-01 state, tests whether threshold margin is 640 mVp-p or more.
02-02-03	Under 02-02-01 state, performs error/alarm measurement and tests whether it is error free.
02-02-04	Tests whether the data threshold of the ED ranges -1.000 V ±0.1 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 2.0 V, the offset is -1.0 Vth) and auto search has been performed.
	Tests whether the data threshold of the ED ranges -2.000 V ±0.3 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 4.0 V, the offset is -2.0 Vth) and auto search has been performed.
02-02-05	Under 02-02-04 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-02-04 state, tests whether threshold margin is 2000 mVp-p or more.
02-02-06	Under 02-02-04 state, performs error/alarm measurement and tests whether it is error free.
02-02-07	Tests whether the data threshold of the ED ranges +1.000 V ±0.1 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 2.0 V, the offset is +1.0 Vth) and auto search has been performed.
	Tests whether the data threshold of the ED ranges +2.000 V ±0.3 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 4.0 V, the offset is +2.0 Vth) and auto search has been performed.
02-02-08	Under 02-02-07 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-02-07 state, tests whether threshold margin is 2000 mVp-p or more.
02-02-09	Under 02-02-07 state, performs error/alarm measurement and tests whether it is error free.
02-02-10	Tests whether the data threshold of the ED ranges -3.000 V ±0.3 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 2.0 V, the offset is -3.0 Vth), and auto search has been performed.
	Tests whether the data threshold of the ED ranges 0.000 V ±0.0 V when the level of the PPG $\overline{\text{Data}}$ output has been set into "VAR" (the amplitude is 4.0 V, the offset is -0.0 Vth), and auto search has been performed.

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (2/6)

Item No.	Diagnosis contents
02-02-11	Under 02-02-10 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-02-10 state, tests whether threshold margin is 2000 mVp-p or more.
02-02-12	Under 02-02-10 state, performs error/alarm measurement and tests whether it is error free.
02-02-13	After PPG's $\overline{\text{Data}}$ output is set "TTL" and Auto search is performed, confirm the ED's Data Threshold is 2.00 V ±0.3 V.
02-02-14	Under 02-02-13 state, tests whether threshold margin is 2000 mVp-p or more.
02-02-15	Under 02-02-13 state, performs error/alarm measurement and tests whether it is error free.
02-03-01	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when settings of PPG and ED have been set into bellow conditions, and auto search has been performed. Pattern type: PRBS15, Mark ratio: 1/2 $\overline{\text{Data}}$ output of PPG: Amplitude 2.0 V and Offset -0.50 Vth
02-03-02	Under 02-03-01 state, tests whether threshold margin is 500 mVp-p or more.
02-03-03	Under 02-03-01 state, performs error/alarm measurement and tests whether it is error free.
02-03-04	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/4 Bit shift: 1 bit
02-03-05	Under 02-03-04 state, tests whether threshold margin is 500 mVp-p or more.
02-03-06	Under 02-03-04 state, performs error/alarm measurement and tests whether it is error free.
02-03-07	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/4 Bit shift: 3 bit
02-03-08	Under 02-03-07 state, tests whether threshold margin is 500 mVp-p or more.
02-03-09	Under 02-03-07 state, performs error/alarm measurement and tests whether it is error free.
02-03-10	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/8 Bit shift: 1 bit
02-03-11	Under 02-03-10 state, tests whether threshold margin is 1600 mVp-p or more.
02-03-12	Under 02-03-10 state, performs error/alarm measurement and tests whether it is error free.
02-03-13	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/8 Bit shift: 3 bit
02-03-14	Under 02-03-13 state, tests whether threshold margin is 500 mVp-p or more.
02-03-15	Under 02-03-13 state, performs error/alarm measurement and tests whether it is error free.
02-03-16	Test whether it is error free when the pattern settings of the PPG and the ED into bellow conditions and error/alarm measurement has been performed. Pattern type: PRBS15 Mark ratio: 0/8

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (3/6)

Item No.	Diagnosis contents
02-03-17	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/2
02-03-18	Under 02-03-17 state, tests whether threshold margin is 500 mVp-p or more.
02-03-19	Under 02-03-17 state, performs error/alarm measurement and tests whether it is error free.
02-03-20	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 3/4 Bit shift: 1 bit
02-03-21	Under 02-03-20 state, tests whether threshold margin is 500 mVp-p or more.
02-03-22	Under 02-03-20 state, performs error/alarm measurement and tests whether it is error free.
02-03-23	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 3/4 Bit shift: 3 bit
02-03-24	Under 02-03-23 state, tests whether threshold margin is 500 mVp-p or more.
02-03-25	Under 02-03-23 state, performs error/alarm measurement and tests whether it is error free.
02-03-26	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 7/8 Bit shift: 1 bit
02-03-27	Under 02-03-26 state, tests whether threshold margin is 500 mVp-p or more.
02-03-28	Under 02-03-26 state, performs error/alarm measurement and tests whether it is error free.
02-03-29	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 7/8 Bit shift: 3 bit
02-03-30	Under 02-03-29 state, tests whether threshold margin is 500 mVp-p or more.
02-03-31	Under 02-03-29 state, performs error/alarm measurement and tests whether it is error free.
02-03-32	Tests whether it is error free when the pattern settings of the PPG and the ED have been set into bellow conditions, and error/alarm measurement has been performed. Pattern type: PRBS15 Mark ratio: 8/8
02-04-01	Tests whether the data threshold of the ED ranges -1.000 ±0.1 V when the settings have been set into bellow conditions, and auto search has been performed. Pattern(PPG&ED): PRBS15, Mark Ratio 1/2 Data interface : Amplitude 2.0 V, Offset -1.0 Vth, DC Impedance 50Ω
	Tests whether the data threshold of the ED ranges -2.000 ±0.1 V when the settings have been set into bellow conditions, and auto search has been performed. Pattern (PPG&ED): PRBS15, Mark Ratio 1/2 Data interface : Amplitude 4.0 V, Offset -2.0 Vth, DC Impedance 50Ω
02-04-02	Under 02-04-01 state, tests whether threshold margin is 1600 mVp-p or more.

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (4/6)

Item No.	Diagnosis contents
	Under 02-04-01 state, tests whether threshold margin is 2000 mVp-p or more.
02-04-03	Under 02-04-01 state, performs error/alarm measurement and tests whether it is error free.
02-05-01	Tests whether the instrument detects SYNC loss occurrence when the Data output is set into "OFF".
02-05-02	Tests whether the instrument detects SYNC loss recovery when the Data output is set into "ON".
02-06-01	Tests whether the data threshold of the ED ranges -1.300 V ±0.13 V when the level of the PPG Data output has been set into "ECL", and auto search has been performed.
02-06-02	Under 02-06-01 state, tests whether threshold margin is 640 mVp-p or more.
02-06-03	Under 02-06-01 state, performs error/alarm measurement and tests whether it is error free.
02-06-04	Tests whether the data threshold of the ED ranges -1.000 V ±0.1 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 2.0, the offset is -1.0 th), and auto search has been performed.
	Tests whether the data threshold of the ED ranges -2.000 V ±0.3 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 4.0 V, the offset is -3.0 Vth), and auto search has been performed.
02-06-05	Under 02-06-04 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-06-04 state, tests whether threshold margin is 2000 mVp-p or more.
02-06-06	Under 02-06-04 state, performs error/alarm measurement and tests whether it is error free.
02-06-07	Tests whether the data threshold of the ED ranges +1.000 V ±0.1 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 2.0 V, the offset is +1.0 Vth), and auto search has been performed.
	Tests whether the data threshold of the ED ranges +2.000 V ±0.3 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 4.0 V, the offset is +2.0 Vth), and auto search has been performed.
02-06-08	Under 02-06-07 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-06-07 state, tests whether threshold margin is 2000 mVp-p or more.
02-06-09	Under 02-06-07 state, performs error/alarm measurement and tests whether it is error free.
02-06-10	Tests whether the data threshold of the ED ranges -3.000 V ±0.3 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 2.0 V, the offset is -3.0 Vth), and auto search has been performed.
	Tests whether the data threshold of the ED ranges -2.000 V ±0.3 V when the level of the PPG Data output has been set into "VAR" (the amplitude is 4.0 V, the offset is -2.0 Vth), and auto search has been performed.
02-06-11	Under 02-06-10 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-06-10 state, tests whether threshold margin is 2000 mVp-p or more.
02-06-12	Under 02-06-10 state, performs error/alarm measurement and tests whether it is error free.
02-06-13	After PPG's Data output is set "TTL" and Auto search is performed, confirm the ED's Data Threshold is 2.00 V ±0.3 V.
02-06-14	Under 02-02-13 state, tests whether threshold margin is 2000 mVp-p or more.
02-06-15	Under 02-02-13 state, performs error/alarm measurement and tests whether it is error free.

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (5/6)

Item No.	Diagnosis contents
02-07-01	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when settings of PPG and ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15, Mark ratio: 1/2 Data output of PPG: Amplitude 0.5 V and Offset -0.50 Vth
02-07-02	Under 02-07-01 state, tests whether threshold margin is 500 mVp-p or more.
02-07-03	Under 02-07-01 state, performs error/alarm measurement and tests whether it is error free.
02-07-04	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/4 Bit shift: 1 bit
02-07-05	Under 02-07-04 state, tests whether threshold margin is 500 mVp-p or more.
02-07-06	Under 02-07-04 state, performs error/alarm measurement and tests whether it is error free.
02-07-07	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/4 Bit shift: 3 bit
02-07-08	Under 02-07-07 state, tests whether threshold margin is 500 mVp-p or more.
02-07-09	Under 02-07-07 state, performs error/alarm measurement and tests whether it is error free.
02-07-10	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/8 Bit shift: 1 bit
02-07-11	Under 02-07-10 state, tests whether threshold margin is 500 mVp-p or more.
02-07-12	Under 02-07-10 state, performs error/alarm measurement and tests whether it is error free.
02-07-13	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 1/8 Bit shift: 3 bit
02-07-14	Under 02-07-13 state, tests whether threshold margin is 500 mVp-p or more.
02-07-15	Under 02-07-13 state, performs error/alarm measurement and tests whether it is error free.
02-07-16	Tests whether it is error free when the pattern settings of the PPG and the ED have been set into bellow conditions and error/alarm measurement has been performed. Pattern type: PRBS15 Mark ratio: 0/8
02-07-17	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: $\overline{1/2}$
02-07-18	Under 02-07-17 state, tests whether threshold margin is 500 mVp-p or more.
02-07-19	Under 02-07-17 state, performs error/alarm measurement and tests whether it is error free.

Table 9-1 Clock Loss/Sync Loss/Threshold&Margin/Mark Ratio/DC Impedance Test (6/6)

Item No.	Diagnosis contents
02-07-20	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 3/4 Bit shift: 1 bit
02-07-21	Under 02-07-20 state, tests whether threshold margin is 500 mVp-p or more.
02-07-22	Under 02-07-20 state, performs error/alarm measurement and tests whether it is error free.
02-07-23	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 3/4 Bit shift: 3 bit
02-07-24	Under 02-07-23 state, tests whether threshold margin is 500 mVp-p or more.
02-07-25	Under 02-07-23 state, performs error/alarm measurement and tests whether it is error free.
02-07-26	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 7/8 Bit shift: 1 bit
02-07-27	Under 02-07-26 state, tests whether threshold margin is 500 mVp-p or more.
02-07-28	Under 02-07-26 state, performs error/alarm measurement and tests whether it is error free.
02-07-29	Tests whether the data threshold of the ED ranges -0.50 V ±0.1 V when the pattern settings of the PPG and the ED have been set into bellow conditions and auto search has been performed. Pattern type: PRBS15 Mark ratio: 7/8 Bit shift: 3 bit
02-07-30	Under 02-07-29 state, tests whether threshold margin is 500 mVp-p or more.
02-07-31	Under 02-07-29 state, performs error/alarm measurement and tests whether it is error free.
02-07-32	Tests whether the error count is 0 when the pattern settings of the PPG and the ED have been set into bellow conditions and error/alarm measurement has been performed. Pattern type: PRBS15 Mark ratio: 8/8
02-08-01	Tests whether the data threshold of the ED ranges -1.000 V ±0.1 V when the settings have been set into bellow conditions and auto search has been performed. Pattern (PPG&ED): PRBS15, Mark Ratio 1/2 Data interface : Amplitude 2.0 V, Offset -1.0 Vth, DC Impedance 50Ω
	Tests whether the data threshold of the ED ranges -2.000 V ±0.3 V when the settings have been set into bellow conditions and auto search has been performed. Pattern (PPG&ED): PRBS15, Mark Ratio 1/2 Data interface : Amplitude 4.0 V, Offset -2.0 Vth, DC Impedance 50Ω
02-08-02	Under 02-08-01 state, tests whether threshold margin is 1600 mVp-p or more.
	Under 02-08-01 state, tests whether threshold margin is 2000 mVp-p or more.
02-08-03	Under 02-08-01 state, performs error/alarm measurement and tests whether it is error free.

Table 9-2 PLL Unlock&Frequency/PRBS Pattern/PDH/SDH Frequency Test (1/2)

Item No.	Diagnosis contents
03-01-01	Tests whether PLL unlock does not occur at 1600001 kHz.
03-01-02	Tests whether the error of frequency measurement is within 10 ppm at 1600001 kHz
03-01-03	Tests whether PLL unlock does not occur at 1700000 kHz.
03-01-04	Tests whether the error of frequency measurement is within 10 ppm at 1700000 kHz
03-01-05	Tests whether PLL unlock does not occur at 1700001 kHz.
03-01-06	Tests whether the error of frequency measurement is within 10 ppm at 1700001 kHz
03-01-07	Tests whether PLL unlock does not occur at 1800000 kHz.
03-01-08	Tests whether the error of frequency measurement is within 10ppm at 1800000 kHz
03-01-09	Tests whether PLL unlock does not occur at 1800001 kHz.
03-01-10	Tests whether the error of frequency measurement is within 10 ppm at 1800001 kHz
03-01-11	Tests whether PLL unlock does not occur at 1900000 kHz.
03-01-12	Tests whether the error of frequency measurement is within 10 ppm at 1900000 kHz
03-01-13	Tests whether PLL unlock does not occur at 1900001 kHz.
03-01-14	Tests whether the error of frequency measurement is within 10 ppm at 1900001 kHz
03-01-15	Tests whether PLL unlock does not occur at 2000000 kHz.
03-01-16	Tests whether the error of frequency measurement is within 10 ppm at 2000000 kHz
03-01-17	Tests whether PLL unlock does not occur at 2000001 kHz.
03-01-18	Tests whether the error of frequency measurement is within 10 ppm at 2000001 kHz
03-01-19	Tests whether PLL unlock does not occur at 2100000 kHz.
03-01-20	Tests whether the error of frequency measurement is within 10 ppm at 2100000 kHz
03-01-21	Tests whether PLL unlock does not occur at 2100001 kHz.
03-01-22	Tests whether the error of frequency measurement is within 10 ppm at 2100001 kHz
03-01-23	Tests whether PLL unlock does not occur at 2200000 kHz.
03-01-24	Tests whether the error of frequency measurement is within 10 ppm at 2200000 kHz
03-01-25	Tests whether PLL unlock does not occur at 2200001 kHz.
03-01-26	Tests whether the error of frequency measurement is within 10 ppm at 2200001 kHz
03-01-27	Tests whether PLL unlock does not occur at 2300000 kHz.
03-01-28	Tests whether the error of frequency measurement is within 10 ppm at 2300000 kHz
03-01-29	Tests whether PLL unlock does not occur at 2300001 kHz.
03-01-30	Tests whether the error of frequency measurement is within 10 ppm at 2300001 kHz
03-01-31	Tests whether PLL unlock does not occur at 2400000 kHz.
03-01-32	Tests whether the error of frequency measurement is within 10 ppm at 2400000 kHz
03-01-33	Tests whether PLL unlock does not occur at 2400001 kHz.
03-01-34	Tests whether the error of frequency measurement is within 10 ppm at 2400001 kHz
03-01-35	Tests whether PLL unlock does not occur at 2500000 kHz.
03-01-36	Tests whether the error of frequency measurement is within 10 ppm at 2500000 kHz
03-01-37	Tests whether PLL unlock does not occur at 2500001 kHz.
03-01-38	Tests whether the error of frequency measurement is within 10 ppm at 2500001 kHz
03-01-39	Tests whether PLL unlock does not occur at 2600000 kHz.
03-01-40	Tests whether the error of frequency measurement is within 10 ppm at 2600000 kHz
03-01-41	Tests whether PLL unlock does not occur at 2600001 kHz.
03-01-42	Tests whether the error of frequency measurement is within 10 ppm at 2600001 kHz
03-01-43	Tests whether PLL unlock does not occur at 2700000 kHz.
03-01-44	Tests whether the error of frequency measurement is within 10 ppm at 2700000 kHz
03-01-45	Tests whether PLL unlock does not occur at 2700001 kHz.
03-01-46	Tests whether the error of frequency measurement is within 10 ppm at 2700001 kHz

Table 9-2 PLL Unlock&Frequency/PRBS Pattern/PDH/SDH Frequency Test (2/2)

Item No.	Diagnosis contents
03-01-47	Tests whether PLL unlock does not occur at 2800000 kHz.
03-01-48	Tests whether the error of frequency measurement is within 10 ppm at 2800000 kHz
03-01-49	Tests whether PLL unlock does not occur at 2800001 kHz.
03-01-50	Tests whether the error of frequency measurement is within 10 ppm at 2800001 kHz
03-01-51	Tests whether PLL unlock does not occur at 2900000 kHz.
03-01-52	Tests whether the error of frequency measurement is within 10 ppm at 2900000 kHz
03-01-53	Tests whether PLL unlock does not occur at 2900001 kHz.
03-01-54	Tests whether the error of frequency measurement is within 10 ppm at 2900001 kHz
03-01-55	Tests whether PLL unlock does not occur at 3000000 kHz.
03-01-56	Tests whether the error of frequency measurement is within 10 ppm at 3000000 kHz
03-01-57	Tests whether PLL unlock does not occur at 3000001 kHz.
03-01-58	Tests whether the error of frequency measurement is within 10 ppm at 3000001 kHz
03-01-59	Tests whether PLL unlock does not occur at 3100000 kHz.
03-01-60	Tests whether the error of frequency measurement is within 10 ppm at 3100000 kHz
03-01-61	Tests whether PLL unlock does not occur at 3100001 kHz.
03-01-62	Tests whether the error of frequency measurement is within 10 ppm at 3100001 kHz
03-01-63	Tests whether PLL unlock does not occur at 3200000 kHz.
03-01-64	Tests whether the error of frequency measurement is within 10 ppm at 3200000 kHz
03-02-01	Tests whether PLL unlock does not occur at 1600000 kHz.
03-02-02	Tests whether the error of frequency measurement is within 10 ppm at 1600000 kHz
03-02-03	Tests whether PLL unlock does not occur at 800000 kHz.
03-02-04	Tests whether the error of frequency measurement is within 10 ppm at 800000 kHz
03-02-05	Tests whether PLL unlock does not occur at 400000 kHz.
03-02-06	Tests whether the error of frequency measurement is within 10 ppm at 400000 kHz
03-02-07	Tests whether PLL unlock does not occur at 200000 kHz.
03-02-08	Tests whether the error of frequency measurement is within 10 ppm at 200000 kHz
03-02-09	Tests whether PLL unlock does not occur at 100000 kHz.
03-02-10	Tests whether the error of frequency measurement is within 10 ppm at 100000 kHz
03-02-11	Tests whether PLL unlock does not occur at 50000 kHz.
03-02-12	Tests whether the error of frequency measurement is within 10 ppm at 50000 kHz
03-02-13	Tests whether PLL unlock does not occur at 25000 kHz.
03-02-14	Tests whether the error of frequency measurement is within 10 ppm at 25000 kHz
03-02-15	Tests whether PLL unlock does not occur at 12500 kHz.
03-02-16	Tests whether the error of frequency measurement is within 10 ppm at 12500 kHz
04-01-01	Tests whether it is error free when pattern type is PRBS7 (1/2 mark ratio) and frequency is 3200000 kHz.
04-01-02	Tests whether it is error free when pattern type is PRBS9 (1/2 mark ratio).
04-01-03	Tests whether it is error free when pattern type is PRBS11 (1/2 mark ratio).
04-01-04	Tests whether it is error free when pattern type is PRBS15 (1/2 mark ratio).
04-01-05	Tests whether it is error free when pattern type is PRBS20 (1/2 mark ratio).
04-01-06	Tests whether it is error free when pattern type is PRBS23 (1/2 mark ratio).
04-01-07	Tests whether it is error free when pattern type is PRBS31 (1/2 mark ratio).
04-02-01	Tests whether it is error free at 51840 kHz.
04-02-02	Tests whether it is error free at 155520 kHz.
04-02-03	Tests whether it is error free at 622080 kHz.
04-02-04	Tests whether it is error free at 2488320 kHz.

Table 9-3 Total Error Addition/PRBS Sync Threshold/PRBS Burst Test

Item No.	Diagnosis contents
05-01-01	Tests whether the measured error rate ranges from 5.0E-2 to 5.0E-4 when the PPG adds 1E-3 rate error.
05-01-02	Tests whether the measured error rate ranges from 5.0E-3 to 5.0E-5 when the PPG adds 1E-4 rate error.
05-01-03	Tests whether the measured error rate ranges from 5.0E-4 to 5.0E-6 when the PPG adds 1E-5 rate error.
05-01-04	Tests whether the measured error rate ranges from 5.0E-5 to 5.0E-7 when the PPG adds 1E-6 rate error.
05-01-05	Tests whether the measured error rate ranges from 5.0E-6 to 5.0E-8 when the PPG adds 1E-7 rate error.
05-01-06	Tests whether the measured error rate ranges from 5.0E-7 to 5.0E-9 when the PPG adds 1E-8 rate error.
05-01-07	Tests whether the measured error rate ranges from 5.0E-8 to 5.0E-10 when the PPG adds 1E-9 rate error.
05-01-08	Tests whether the measured error count is 1 when the PPG adds single error.
06-01-01	Tests whether it is error free when the settings is same conditions as following. Sync Gain threshold: 1E-5, Sync Loss threshold: 1E-4, Error Addition: OFF Pattern type: PRBS15
06-01-02	Tests whether SYNC loss is not detected when the PPG adds 1E-4 rate error under 06-01-01 state.
06-01-03	Tests whether SYNC loss is detected when the PPG adds 1E-3 rate error under 06-01-01 state.
06-01-04	Tests whether SYNC loss is not detected when the PPG adds 1E-5 rate error under 06-01-01 state.
06-01-05	Tests whether SYNC loss is not detected when the PPG adds 1E-6 rate error under 06-01-01 state.
06-01-06	Tests whether it is error free when the settings are same conditions as following. Sync Gain threshold: 1E-8, Sync Loss threshold: 1E-7 Error Addition: OFF Pattern type: PRBS15
06-01-07	Tests whether SYNC loss is not detected when the PPG adds 1E-7 rate error under 06-01-06 state.
06-01-08	Tests whether SYNC loss is detected when the PPG adds 1E-6 rate error under 06-01-06 state.
06-01-09	Tests whether SYNC loss is not detected when the PPG adds 1E-8 rate error under 06-01-06 state.
06-01-10	Tests whether SYNC loss is not detected when the PPG adds 1E-9 rate error under 06-01-06 state.
06-02-01	Tests whether it is error free when burst pattern is measured. The burst cycle is 50000us, the enable length is 1us, pattern type is PRBS15.
06-02-02	Tests whether it is error free when burst pattern is measured. The burst cycle is 50000 us, the enable length is 49999 us, pattern type is PRBS15.

Table 9-4 Zero-Subst Sync Threshold/PRGM Sync Threshold/PRGM Burst Test (1/2)

Item No.	Diagnosis contents
07-01-01	Tests whether it is error free when the settings are same conditions as following. Sync Gain threshold: 1E-5, Sync Loss threshold: 1E-4, Sync method: "Normal" Error Addition: OFF Pattern type: Zero-Subst (2^{15})
07-01-02	Tests whether SYNC loss is not detected when the PPG adds 1E-4 rate error under 07-01-01 state.
07-01-03	Tests whether SYNC loss is detected when the PPG adds 1E-3 rate error under 07-01-01 state.
07-01-04	Tests whether SYNC loss is not detected when the PPG adds 1E-5 rate error under 07-01-01 state.
07-01-05	Tests whether SYNC loss is not detected when the PPG adds 1E-6 rate error under 07-01-01 state.
07-01-06	Tests whether it is error free when the settings are same conditions as following. Sync Gain threshold: 1E-8, Sync Loss threshold: 1E-7, Sync method: "Normal" Error Addition: OFF Pattern type: Zero-Subst (2^{15})
07-01-07	Tests whether SYNC loss is not detected when the PPG adds 1E-7 rate error under 07-01-06 state.
07-01-08	Tests whether SYNC loss is detected when the PPG adds 1E-6 rate error under 07-01-06 state.
07-01-09	Tests whether SYNC loss is not detected when the PPG adds 1E-8 rate error under 07-01-06 state.
07-01-10	Tests whether SYNC loss is not detected when the PPG adds 1E-9 rate error under 07-01-06 state.
08-01-01	Tests whether it is error free the settings are same conditions as following. Pattern type: PRGM Pattern length: with 8,388,608 bits (edited 1/2 mark ratio) Sync method: "Frame" Frame length: 32 bits
08-01-02	Tests whether it is error free when the pattern logic is inverted under 08-01-01 state.
09-01-01	Tests whether it is error free when the settings are same conditions as following. Sync Gain threshold: 1E-5, Sync Loss threshold: 1E-4, Sync method: "Frame" Frame length: 32 bits Error Addition: OFF Pattern type: PRGM Pattern length: 8,388,608
09-01-02	Tests whether SYNC loss is not detected when the PPG adds 1E-4 rate error under 07-01-01 state.
09-01-03	Tests whether SYNC loss is detected when the PPG adds 1E-3 rate error under 09-01-01 state.
09-01-04	Tests whether SYNC loss is not detected when the PPG adds 1E-5 rate error under 09-01-01 state.
09-01-05	Tests whether SYNC loss is not detected when the PPG adds 1E-6 rate error under 09-01-01 state.
09-01-06	Tests whether it is error free when the settings are same conditions as following. Sync Gain threshold: 1E-8, Sync Loss threshold: 1E-7, Sync method: "Frame" Frame length: 32 bits Error Addition: OFF Pattern type: PRGM Pattern length: 8,388,608
09-01-07	Tests whether SYNC loss is not detected when the PPG adds 1E-7 rate error under 09-01-06 state.
09-01-08	Tests whether SYNC loss is detected when the PPG adds 1E-6 rate error under 09-01-06 state.
09-01-09	Tests whether SYNC loss is not detected when the PPG adds 1E-8 rate error under 09-01-06 state.

Table 9-4 Zero-Subst Sync Threshold/PRGM Sync Threshold/PRGM Burst Test (2/2)

Item No.	Diagnosis contents
09-01-10	Tests whether SYNC loss is not detected when the PPG adds 1E-9 rate error under 09-01-06 state.
09-02-01	Tests whether it is error free when burst pattern is measured. The burst cycle is 50000 us, the enable length is 1us, pattern is 8,388,608 bits length PRGM.
09-02-02	Tests whether it is error free when burst pattern is measured. The burst cycle is 50000 us, the enable length is 49999 us, pattern is 8,388,608 bits length PRGM.

Table 9-5 INS/OMI Error Addition/Clock Delay Test

Item No.	Diagnosis contents
10-01-01	Tests whether it is error free when the settings are same conditions as following. Sync method: "Normal" Pattern type: PRGM Pattern length: 8,388,608 (edited all bits 0)
10-02-01	Tests whether it is error free when the pattern logic is inverted under 10-01-01 state.
10-03-01	Tests whether insertion errors are counted when the PPG adds errors under 10-01-01 state.
10-03-02	Tests whether no omission errors are counted when the PPG adds errors under 10-01-01 state.
11-01-01	Tests whether it is error free when the settings are same conditions as following. Sync method: "Normal" Pattern type: PRGM Pattern length: 8,388,608 (edited all bits 1)
11-02-01	Tests whether it is error free when the pattern logic is inverted under 11-01-01 state.
11-03-01	Tests whether insertion errors are counted when the PPG adds errors under 11-01-01 state.
11-03-02	Tests whether no omission errors are counted when the PPG adds errors under 11-01-01 state.
12-01-01	Tests whether busy state is canceled when the clock delay of the PPG has changed into -1000 ns from 0 ns.
12-01-02	Tests whether busy state is canceled when the clock delay of the PPG has changed into +1000 ns from -1000 ns.
12-01-03	Tests whether busy state is canceled when the clock delay of the PPG has changed into -1000 ns from +1000 ns.
12-01-04	Tests whether busy state is canceled when the clock delay of the ED has changed into -1000 ns from 0 ns.
12-01-05	Tests whether busy state is canceled when the clock delay of the ED has changed into +1000 ns from -1000 ns.
12-01-06	Tests whether busy state is canceled when the clock delay of the ED has changed into -1000 ns from +1000 ns.

(Blank)

CHAPTER10 MAINTENANCE·SCRAPPING

10.1 Introduction

This chapter describes about daily maintenance, transportation, and scrapping of the MU163220A and MU163240A (hereafter called these units).

10.2 Daily Maintenance

1. If the surface of the unit is stained, wipe it with a cloth damped with synthetic detergent.
2. If dust settles on the surface of the unit, remove it with a vacuum cleaner.
3. If the mounted parts becomes loose, tighten screws with the specified tools.

10.2.1 Precautions for Storage

When storing these units, follow the precautions given below.

1. Before storing this unit, remove dust and stain.
2. Avoid storing this unit in a place where the temperature becomes higher than +60°C or lower than -20°C or the humidity becomes higher than 85%.
3. Do not store this unit in a place exposed to direct sunlight or heavy dust.
4. Do not store this unit in a place exposed to water splashes or active gases.
5. Do not store this unit in a place where oxidization could occur or in a place exposed to strong vibrations.

- Recommended log-term storage conditions

The instrument should be stored over a long period of tike in an environment meeting the following conditions, as well as those suggested above.

1. Temperature : 5 to 30°C
2. Relative humidity : 40 to 75%
3. Little temperature and humidity change per day

10.3 Transportation

When transporting this unit, use the original package if it has been stored. If you do not have the original package, pack the unit as described below. Be sure to put on clean gloves and handle the unit carefully so that the unit does not get scratched or dented.

1. Remove dust off the unit surface using a dry cloth.
2. Check screws for looseness and slipping out.
3. Cover the projections and easy-to-deform portions with protective materials and wrap the unit with a polyethylene sheet and moisture-proof paper.
4. Put the packed unit in the corrugated cardboard box and fasten the seams with adhesive tape. Crate the package depending on the transportation distance and method.

10.4 Scrapping

This instrument contains GaAs. Its scrapping must conform to the requirements of the governing national and local regulations.

(Blank)

APPENDIXES

MP1632A enables you to select one of the following five types of sendable and receivable patterns:

(1) Programmable pattern (PRGM pattern)
(2) Pseudo random binary sequence pattern (PRBS pattern)
(3) Zero-substitution pattern (Zero-Subst pattern)

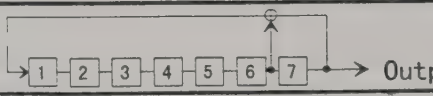
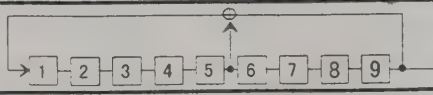
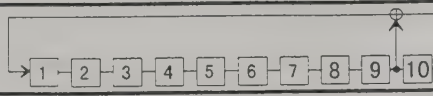
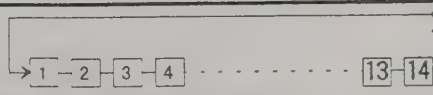
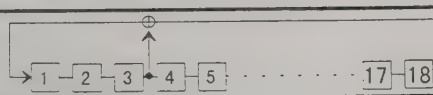
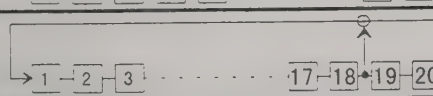
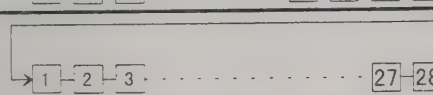
PRGM pattern

A pattern the user can specify arbitrarily. For a channel set in the PRGM pattern, a sent or received pattern can be edited using the Pattern Editor dialog box and Customize panel.

PRBS (Pseudo Random Binary Sequence) pattern

A pattern generated by the principle shown in Table 1. If successive N bits are selected in a bit array of the PRBS pattern having a 2^N - 1 cycle, the same bit array as this bit array does not exist in one cycle. In other words, the PRBS pattern has all assumable bit arrays other than 0. Using the PRBS pattern as a test signal, the user can execute the test under conditions similar to an actual signal that passes through a transmission line.
For the PRBS output pattern, logical value 1 corresponds to low level and logical value 0 to high level.
The circuit shown in Figure 1 enables to set a PRBS pattern marking rate (logical value 1 generation probability in pattern) to 1/2, 1/4, and 1/8. As shown in Figure 1, there are two methods of generating the 1/4 and 1/8 marking rates: ANDing with a bit shifted by one bit and ANDing with a bit shifted by three bits. Inverting the logical value of these bits enables to generate a 1/2inv, 3/4, and 7/8 marking rates.

Table 1 Pseudo random binary sequence pattern generation principle

Period	Generation polynomial	Pattern generation block diagram
2^7-1	$1+X^6+X^7$	
2^9-1	$1+X^5+X^9$	
$2^{11}-1$	$1+X^9+X^{11}$	
$2^{15}-1$	$1+X^{14}+X^{15}$	
$2^{20}-1$	$1+X^3+X^{20}$	
$2^{23}-1$	$1+X^{18}+X^{23}$	
$2^{31}-1$	$1+X^{28}+X^{31}$	

N : Shift register
⊕ : Exclusive-OR

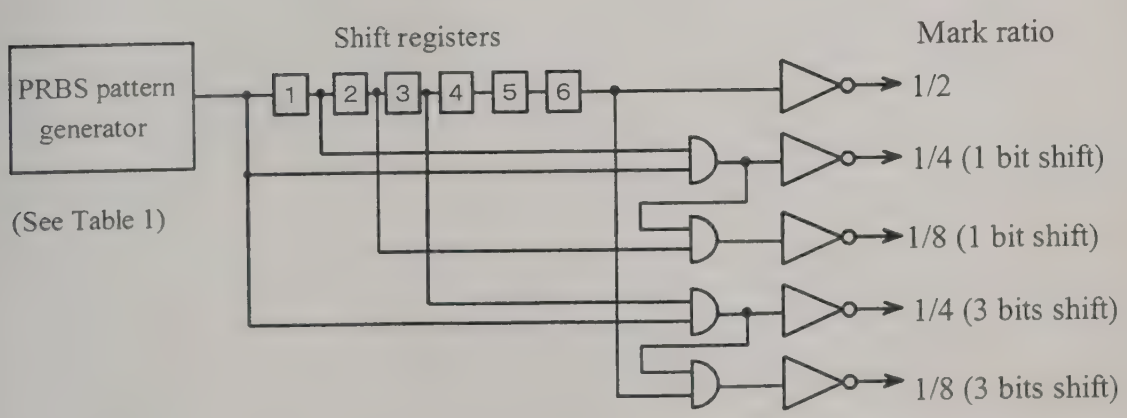
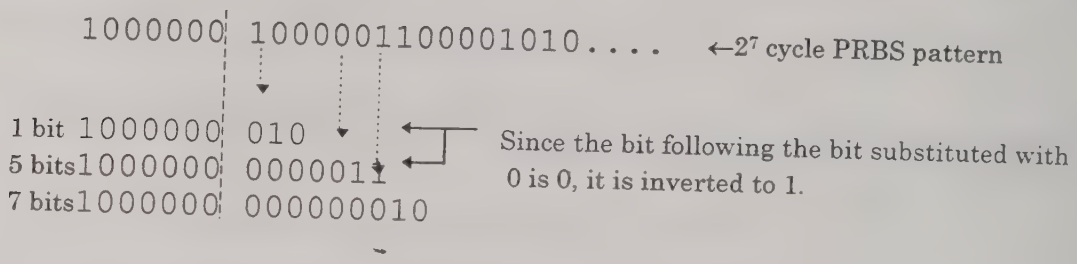


Fig. 1 Marking rate 1/4, 1/8 generator circuit

Zero-Subst pattern

In this pattern, values following the longest successive 0s in a PRBS pattern in which a bit having a logical value 1 is added are substituted with logical value 0 by the specified number of bits. When the bit following the bit substituted with 0 is 0, it is inverted to 1.

Example: 2^7 cycle PRBS
The number of longest successive 0s is 7 - 1 = 6 bits, and the substitution with 0 begins with the position below.


1000000 10000011000010 10....
←2^7 cycle PRBS pattern
1 bit 1000000 010
5 bits1000000 0000011
7 bits1000000 000000010
Since the bit following the bit substituted with 0 is 0, it is inverted to 1.

To generate a burst pattern, specify two attributes: burst cycle and enable length. As shown in Figure 7, the burst cycle means a cycle ranging from the restart of pattern generation to its next restart. The enable length means a duration in which a pattern is generated in the burst cycle.
A burst trigger signal is generated in the PPG unit according to the specified burst cycle and enable length. It is available to control the pattern generation.
The burst trigger signal is also input from an external unit. An external signal is input from the EXT Burst Input connector on the rear of the PPG unit. In this case, the burst cycle and enable length cannot be specified in the PPG unit.
Patterns generated successively are generically called a repeat pattern. In other words, the repeat pattern means a burst pattern having "burst cycle = enable length."

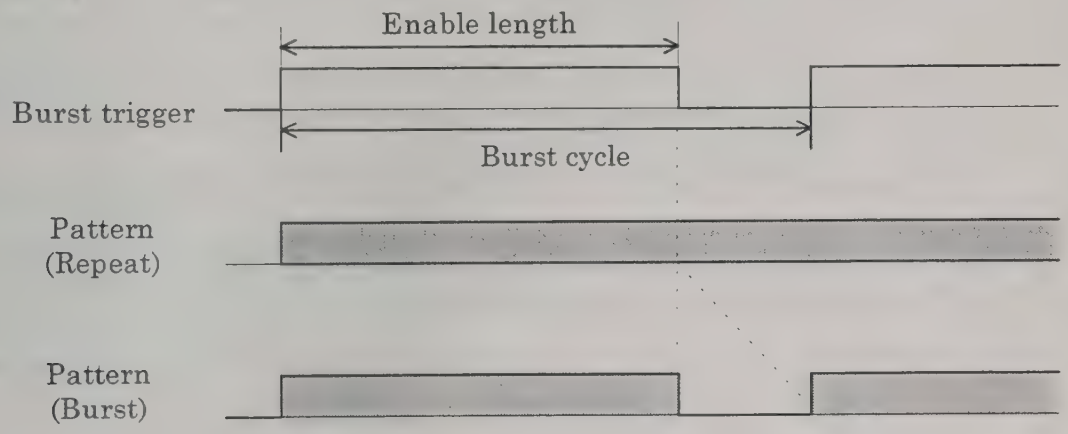


Fig. 2 Burst Pattern Generation Principle

- **Auto Sync n pattern cycle**

Auto Sync is a function that automatically synchronizes a pattern received by the ED unit with a reference pattern in the ED unit. If an error rate exceeds a specific threshold value during measurement as Auto Sync is ON, the ED unit assumes that the synchronization of the input pattern with the reference pattern is released. In this case, the ED unit generates the Pattern Sync Loss alarm to stop the error count, recovers the synchronization, and restarts the error count.
In the Pattern Sync mode, there are two methods of recovering the synchronization.

Normal	Recovers the synchronization while comparing the input pattern with the reference pattern and switching Demux route order and bit shifting, during one full cycle.
Frame	A synchronization recovery trigger is assumed to be a timing when the same pattern as a specified frame (some bits at the beginning of the reference pattern) appears in the input pattern. If pattern type is set to PRBS, you cannot select this Pattern Sync mode.

As compared with Normal, Frame is available to release the synchronization at higher speed. When bit rows having the same pattern exist at different positions in a frame, the input pattern may abnormally synchronize with the reference pattern.

When the data output and clock output levels are set to Variable, they are uniquely determined depending on two values: offset voltage (Voh, Vth, or Vol) and amplitude.

When amplitude and Voh are already specified:

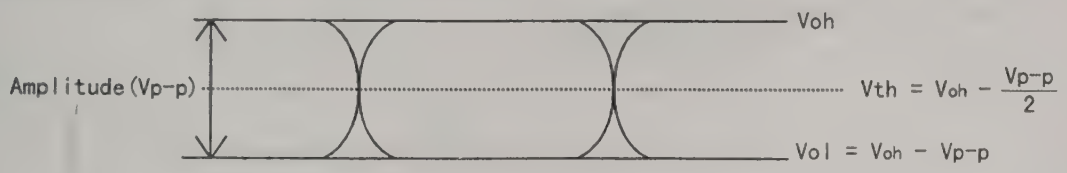


Fig. 3

When amplitude and Vth are already specified:

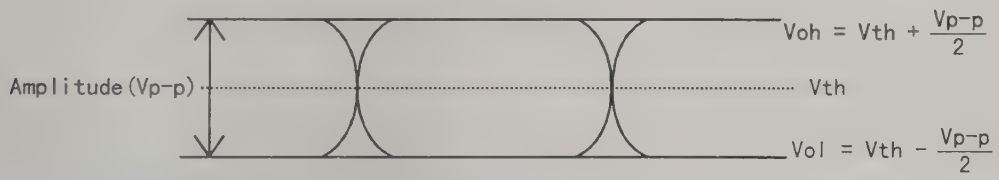


Fig. 4

When amplitude and Vol are already specified:

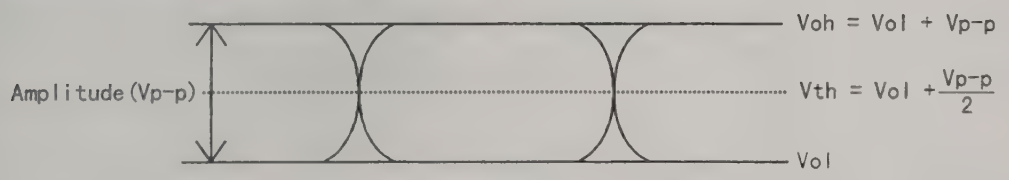
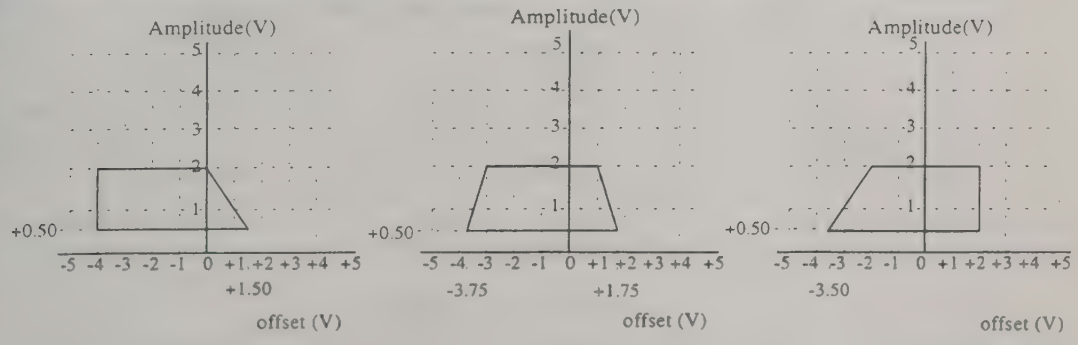


Fig. 5

Fig. 6 shows the amplitude and offset settable range for each terminal value.



(a) Vol (b) Vth (c) Voh

Fig. 6 Relationships between amplitude and offset

The error addition method can be selected in the Error Addition dialog box. This section explains how to add an error in each method.

1. Single

A 1-bit error is inserted at a timing when the Single button is pressed while the lamp on the side of the Error Addition button lights on.

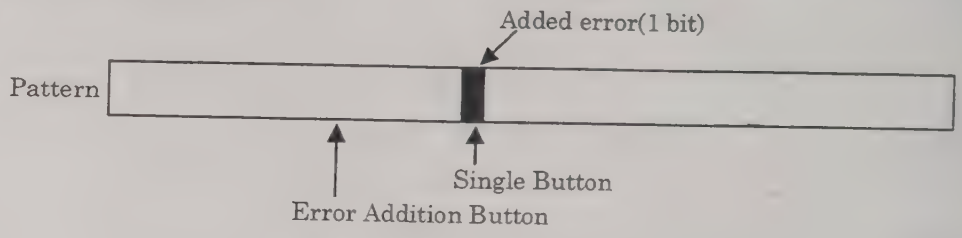


Fig. 7 Error addition (1)

2. Rate (1E-3 to 1E-9)

An error is successively added with the specified rate after the Error Addition button is pressed.

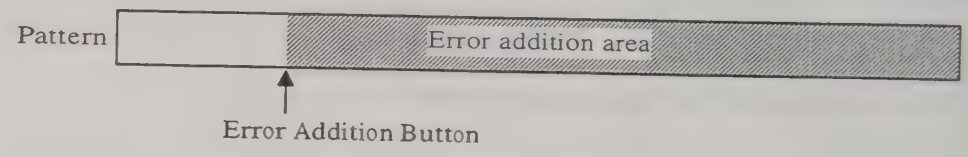


Fig. 8 Error addition (2)

3. EXT

A 1-bit error is added synchronously with the falling edge of a pulse signal sent from the EXT ERR Input connector on the rear panel of the PPG unit.

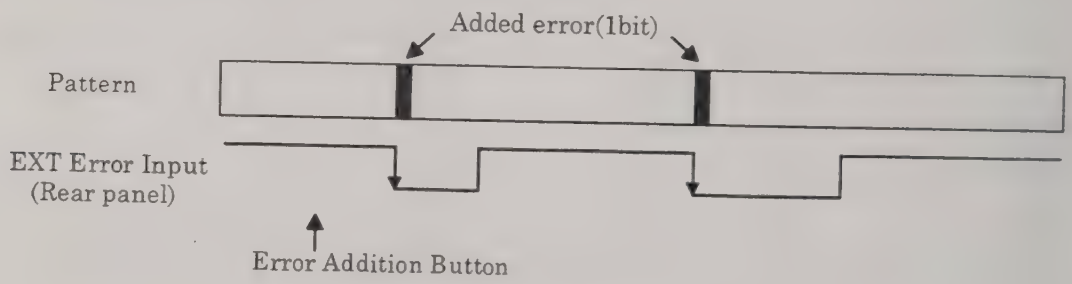


Fig. 9 Error addition (3)

- **Error/Alarm measurement immediate data**

This section shows a printing format used when File-Print is selected on the master window menu to specify Error/Alarm output while an error alarm is measured by the MU163240A 3.2G error detector.

```
--------------- MP1632A Error/Alarm Immediate Data ------------
Start Time 98-07-01 14:25:00       Intermediate Time 98-07-01 14:26:00
Power Fail Interval  *.****E**
Alarm Interval
    Clock Loss Sync Loss
-------------------------------
    *.****E**  *.****E**
-------------------------------
Error
          ER           EC          EI        %EFI
-----------------------------------------------
INS     *.****E-**  *.****E**  ---------  --------       ←*1
OMI     *.****E-**  *.****E**  ---------  --------
Total   ---------   --------- *.****E**  ***.****%
-----------------------------------------------
Threshold EI
    >1E-3    >1E-4      >1E-5     ···          >1E-8     =<1E-8
-------------------------------------------------------------
INS     *.****E** *.****E** *.****E**          *.****E** *.****E**  ←*2
OMI     *.****E** *.****E** *.****E**          *.****E** *.****E**
Total   *.****E** *.****E** *.****E**          *.****E** *.****E**
-------------------------------------------------------------
Threshold %EFI
    >1E-3    >1E-4      >1E-5     ···          >1E-8      =<1E-8
-------------------------------------------------------------
INS      ***.****%  ***.****% ***.****%        ***.****% ***.****%  ←*2
OMI      ***.****%  ***.****% ***.****%        ***.****% ***.****%
Total    ***.****%  ***.****% ***.****%        ***.****% ***.****%
-------------------------------------------------------------
Error Performance
        ES     EFS          SES          US          DM        EC
-----------------------------------------------------------------------
INS     *.****E** *.****E** *.****E** *.****E** *.****E** *.****E** ←*2
OMI     *.****E** *.****E** *.****E** *.****E** *.****E** *.****E**
Total   *.****E** *.****E** *.****E** *.****E** *.****E** *.****E**
-----------------------------------------------------------------------
Error Performance
     ES%              %EFS      %SES         %US         %DM
-----------------------------------------------------------
INS     ***.****% ***.****% ***.****% ***.****% ***.****%     ←*2
OMI     ***.****% ***.****% ***.****% ***.****% ***.****%
Total   ***.****% ***.****% ***.****% ***.****% ***.****%
-----------------------------------------------------------
Clock Frequency
-----------------
    *******.*kHz
-----------------
```

*1: This format is depend on the Error Type on the 'Measurement: Test Menu' panel. If "INS/OMI" is selected, three lines are printed out as shown above, if "Total" is selected, only the third line whose beginning is "Total" is printed out.

*2: These formats are depend on the Error Type on the 'Measurement: Test Menu' panel. If "INS/OMI" is selected two lines whose beginning is "INS" or "OMI" are printed out, if "Total" is selected only the third line whose beginning is "Total" is printed out.

- **Eye margin result**

Threshold margin

```
-------------MP1632A 3.2G ED Threshold Margin--------------

Start Time 98-07-01-15:30:00    End Time   98-07-01-15:31:50
Error Rate  *.****E-*
Phase       ********** ps
>> Result <<
Threshold Margin   ********** mV
```

Phase margin

```
-------------MP1631A 1.6G ED Phase Margin--------------

Start Time 96-02-02-15:30:00    End  Time 98-07-01-15:31:50
Error Rate  *.****E-*
Threshold   ********** mV
>> Result <<
Phase Margin       ********** ps
```

Phase&Threshold margin

```
-------------MP1632A 3.2G ED Phase&Threshold Margin-------------

Start Time 96-02-02-15:30:00    End Time   98-07-01-15:31:50
Error Rate  *.****E-*
Threshold   ********** mV
Phase       ********** ps
>> Result <<
Threshold Margin   ********** mV
Phase Margin       ********** ps
```

Eye Diagram

```
-------------MP1632A 3.2G ED Eye Diagram-----------------

Start Time 98-07-01 15:30:00    End Time  98-07-01 15:31:50
Threshold   ********** mV
Phase       ********** ps
>> Result <<
************************** 1E-3 ****************************
 1.(***.*,***.***)    2.(***.*,***.***) ··· 4.(***.*,***.***) ←*1
 5.(***.*,***.***)    6.(***.*,***.***) ··· 8.(***.*,***.***)
                                  :
                                  :
29.(***.*,***.***)   30.(***.*,***.***) ··· 32.(***.*,***.***)
************************** 1E-4 ****************************
 1.(***.*,***.***)    2.(***.*,***.***) ··· 4.(***.*,***.***) ←*1
 5.(***.*,***.***)    6.(***.*,***.***) ··· 8.(***.*,***.***)
                                  :
                                  :
************************** 1E-12 ***************************
 1.(***.*,***.***)    2.(***.*,***.***) ··· 4.(***.*,***.***) ←*1
 5.(***.*,***.***)    6.(***.*,***.***) ··· 8.(***.*,***.***)
                                  :
                                  :
29.(***.*,***.***)   30.(***.*,***.***) ··· 32.(***.*,***.***)
```

*1 Each result is shown as coordinate whose X-axis is phase, Y-axis is threshold.

- **Pattern**

```
-------------------MP1632A 3.2G ED Pattern (Slot 4)-----------------

        0                      64                     128
      + ---------------------+------------------------------------ +
        ----
     0| 00 0A 3C EE 53 21 01 0E 48 FF C9 CC 67 85 4D 66  ···          |
   192| 01 02 03 55 CD CD E7 00 35 7E 54 A0 0B 5B 54 22  ···          |
   384| DD CB 5E 90 26 71 A9 BA EE 87 77 20 00 03 FE 6D  ···          |
      |                                  :                          |
      |                                  :                          |
 13056| 55 6C 67 80 01 28 01 21 D8 89 7C 1C 7D 90 AA 00  ···          |
      + ---------------------+------------------------------------ +
```

- **Explanation of measurement terms**

(1) Error rate

$$\frac{\text{Number of error pulses to be measured in specified}}{\text{Number of clocks to be measured in specified time}}$$

(2) Number of errors

Number of error pulses in specified time

(3) Number of error intervals (EI)

Number of intervals including one or more error pulses in specified measurement time. The interval time is 100 ms or 1 sec.

(4) Error free interval rate (%EFI)

A rate of the total number of intervals with the number of intervals excluding intervals having one or more error pulses in specified measurement time. The error free interval rate is obtained from EI in the expression below.

$$\%EFI = \left(\frac{\text{Number of measured intervals - EI}}{\text{Number of measured intervals}} \times 100\% \right)$$

The interval time is 100 ms or 1 sec.

(5) Number of power fail intervals

Number of intervals in which power cut-off occurred

(6) Number of clock loss intervals

Number of intervals in which clock cut-off occurred

(7) Number of SYNC loss intervals

Number of intervals in which asynchronization occurred.

(8) Threshold EI

Number of intervals in which the 1-second average error rate satisfies the threshold conditions below in the specified measurement time

1-second average error rate $>10^{-3}$, $>10^{-4}$, $>10^{-5}$, $>10^{-6}$, $>10^{-7}$, $>10^{-8}$, $\leq 10^{-8}$

(9) Threshold %EFI

A rate of the total number of intervals with the number of intervals in which the 1-second average error rate does not satisfy the threshold conditions shown in item (8) in the specified measurement time. This rate is obtained from threshold EI in the expression below.

$$\text{Threshold \%EFI} = \left(\frac{\text{Number of measurement intervals - Threshold EI}}{\text{Number of measurement intervals}} \right) \times 100\%$$

- **Error performance data**

  A parameter used to estimate the transmission line defined in ITU-T (old CCITT) Recommendation G821. The range from the start of measurement to the end of measurement is divided into an available and unavailable periods in 1-second intervals. Various items are mainly obtained in the available period.

(1) Definition of available and unavailable periods

When a unavailable interval of which 1-second average error rate exceeds the unavailable threshold is continued for 10 seconds, the unavailable period begins; the 10 seconds is included in the unavailable period.
When an unavailable interval of which 1-second average error rate does not exceed the unavailable threshold is continued for 10 seconds in the unavailable period, the unavailable period ends and the 10 seconds is included in the unavailable period.

(2) Unavailable threshold and DM threshold

The unavailable threshold and DM threshold can be selected on the Measurement Condition dialog box (see Figure 5-69).

Unavailable threshold = 10^{-3}, DM threshold = 10^{-6}
Unavailable threshold = 10^{-4}, DM threshold = 10^{-8}

(3) Measurement items

- Error count (EC)
  A bit error count value in measurement duration

- Error second (ES)
  Total number of intervals in which one or more bit errors occurred in the available period

- Error free second (EFS)
  Total number of intervals in which no bit error occurred in the available period

- Severe error second (SES)
  Total number of intervals in which a bit error exceeding the unavailable threshold occurred in the available period

- Unavailable second (US)
  When SES continues for 10 seconds or more, its beginning is assumed to be the beginning of the unavailable time. If other than SES continues for 10 seconds or more, the part preceding its beginning is assumed to be the end of the unavailable time. When a measurement cycle ends and the next one starts while deciding whether the unavailable time starts or ends, the decision counter is reset at the start of measurement.

- Degraded minutes (DM)
  This system obtains an error rate every 60 packets excluding SES above, in available intervals calculated for the available time. The degraded minutes means the total number of packets of which the error rate exceeds the DM threshold. One is added to a duration in which 60 seconds is not satisfied at the end of measurement if the duration exceeds the DM threshold.

- Error second rate (%ES)
  A rate of all intervals calculated for the available time with error intervals calculated for the available time

- Error free second rate (%EFS)
  A rate of all intervals calculated for the available time with error free intervals calculated for the available time

- Severe error second rate (%SES)
  A rate of all intervals calculated for the available time with unavailable intervals calculated for the available time

- Unavailable second rate (%US)
  A rate to a measurement time in unavailable time

- Degraded minutes rate (%DM)
  An error rate is obtained every 60 packets excluding SES above in available intervals calculated for the available time. A rate of all packets with the number of packets of which error rate exceeds the DM threshold

- **Measured data processing at alarm occurrence**

(1) Power fail

Power cut-off processing is valid only when it is specified. For details on specifying power cut-off processing, refer to Section 6.4, "Specifying System Operations" in the MP1632A Digital Data Analyzer Operation Manual.
If power fail occurs during measurement, data measured until just before the interval in which power fail occurred is held while the power is cut off.

(a) Error measurement
This system excludes the number of clocks and number of errors calculated in the interval in which power fail occurred. After power fail was recovered, measurement is continued if measured data is held correctly.

(b) Interval and threshold interval measurements
This system includes the intervals in which power fail occurred and intervals in which power fail is continued in the number of power fail intervals, and does not include other items.
After power fail was recovered, measurement is continued if measured data is held correctly.

(c) Error performance
An interval that was being decided at occurrence of power fail is not calculated for the unavailable and available seconds.
After power fail was recovered, measurement is restarted from the initial state.

(2) Clock loss

When clock loss occurs during measurement, the user can select one of the following two methods:

(a) Excluding clock loss processing from calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which clock loss occurred are not calculated.

(ii). Interval and threshold interval measurements
The interval in which clock loss occurred is calculated only for the clock loss interval, not other items.

(iii). Error performance
The interval in which clock loss occurred is not calculated for the unavailable and available seconds. Neither is an interval that was being decided calculated for unavailable and available seconds.
After clock loss is recovered, measurement is continued from the initial state.

(b) Including clock loss processing in calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which clock loss occurred are not calculated.

(ii). Interval and threshold interval measurements
The interval in which clock loss occurred is calculated as a clock loss interval and included in the total number of intervals; however, it is not included in the number of threshold EIs.

(iii). Error performance
The interval in which clock loss occurred is calculated for a unavailable interval. If the interval is calculated for an available second, it is also included in the number of error seconds.

(3) SYNC loss

When a SYNC loss occurred during measurement, the user can select one of the following two methods:

(a) Excluding SYNC loss processing from calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which SYNC loss occurred are not calculated.

(ii). Interval and threshold interval measurements
The interval in which SYNC loss occurred is calculated only for the SYNC loss interval, and not for other items.

(iii). Error performance
The interval in which SYNC loss occurred is not calculated for unavailable and available seconds. Neither is an interval that was being decided calculated in unavailable and available seconds.
After SYNC loss is recovered, measurement is continued from the initial state.

(b) Including SYNC loss processing in calculation

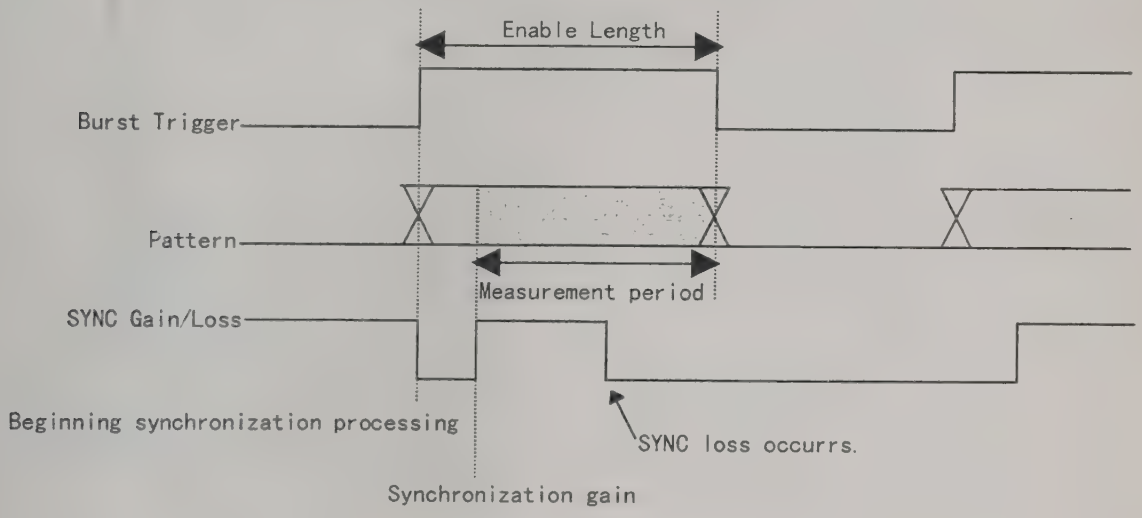
(i). Error measurement
The number of clocks and errors measured in the interval in which SYNC loss occurred are not calculated.

(ii). Interval and threshold interval measurements
The interval in which SYNC loss occurred is calculated as an SYNC loss interval and included in the total number of intervals; however, it is not included in the number of threshold EIs.

(iii). Error performance
The interval in which SYNC loss occurred is assumed to be a unavailable interval. If the interval is calculated for an available second, it is also included in the number of error seconds.

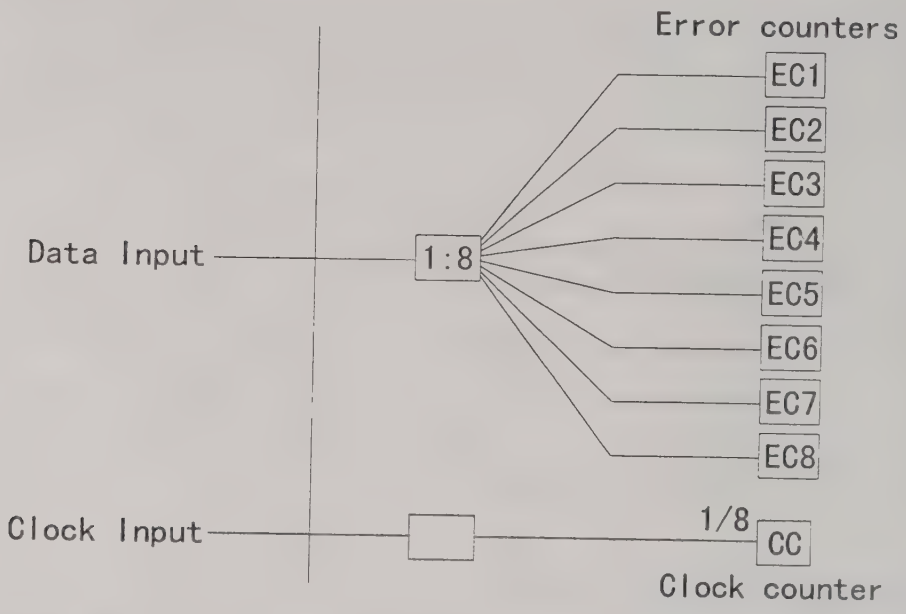
During MU163240A receives burst pattern, it measures the pattern only for a period that the burst trigger signal is high. When the burst trigger signal rises, MU163240A first becomes a synchronization state then it begins synchronization processing. The period until it gains synchronization is not included in the measurement period although the burst trigger signal is high.

The SYNC Gain/Loss is forced to fall when the burst trigger signal rises. It remains low until the measurement period starts, then raises and falls according to synchronization state for measurement period. While the burst trigger signal is low, the SYNC Gain/Loss signal keeps the state at the end of last measurement period.



This section describes error rate calculate method depend on the internal route mask setting.

Input data signal of MU163240A is demultiplexed into eight routes. Every route has a their own error counter. Consequently MU163240A has eight error counters. Input clock of MU163240A is divided by 8.



The error rate calculate method is depend on the internal route mask condition.

- No masks
  Error Rate = (EC1+EC2+EC3+EC4+EC5+EC6+EC7+EC8)/(CC×8)

- Mask from the second mask to the eighth
  Error Rate = (EC1)/(CC)

- Mask from the third mask to the eighth
  Error Rate = (EC1+EC2)/(CC×2)

(Example 1) Errors are distributed evenly
Assumption: EC1 = EC2 = EC3 = EC4 = EC5 = EC6 = EC7 = EC8 = 1, CC = 1000
If no route is masked
Error Rate = (1+1+1+1+1+1+1+1)/(1000×8) = 0.001
If the from second route to eighth are masked
Error Rate = 1/1000 = 0.001

(Example 2) Errors are distributed partially to a route.(e.g. Error addition by PPG unit)
Assumption: EC1 = 8, EC2 = EC3 = EC4 = EC5 = EC6 = EC7 = EC8 = 0, CC = 1000
If no route is masked
Error Rate = (8+0+0+0+0+0+0+0)/(1000×8) = 0.001
If the from second route to eighth are masked
Error Rate = 8/1000 = 0.008

Appendix J Internal Threshold

The internal threshold values for synchronization / asynchronization is depend on the pattern type and the pattern synchronization method. This section describes these threshold value.

- PRBS pattern

Sync Loss Threshold	Sync Gain Threshold
2000 / 80000	1 / 64

- PRGM or Zero-Subst pattern with "Frame" synchronization method

Pattern Length	Sync Loss Threshold	Sync Gain Threshold
8 to 5120	100 / 1200000	1 / Pattern Length
5121 to 10240	100 / 2200000	1 / Pattern Length
10241 to 51200	100 / 10400000	1 / Pattern Length
51201 to 102400	100 / 22000000	1 / Pattern Length
102401 to 204800	100 / 42000000	1 / Pattern Length
204801 to 307200	100 / 64000000	1 / Pattern Length
307201 to 409600	100 / 82000000	1 / Pattern Length
409601 to 524288	100 / 104857600	1 / Pattern Length
524289 to 1048576	100 / 220000000	1 / Pattern Length
1048577 to 2097152	100 / 420000000	1 / Pattern Length
2097153 to 4194304	100 / 840000000	1 / Pattern Length
4194305 to 8388608	100 / 1680000000	1 / Pattern Length

- PRGM or Zero-Subst pattern with "Normal" synchronization method

Pattern Length	Sync Loss Threshold	Sync Gain Threshold
2 to 16	2000 / 80000	1 / 64
17 to 160	200 / 80000	1 / 640
161 to 1600	20 / 80000	1 / 6400
1601 to 16000	2 / 80000	1 / 64000
16001 to 80000	2 / 400000	1 / 160000
80001 to 160000	2 / 800000	1 / 320000
160001 to 320000	2 / 1600000	1 / 640000
320001 to 524288	2 / 2097152	1 / 1280000
524289 to 1048576	2 / 4194304	1 / 2560000
1048577 to 2097152	2 / 8388608	1 / 5120000
2097153 to 4194304	2 / 16777216	1 / 10240000
4194305 to 8388608	2 / 33554432	1 / 20480000

1 Pesudorandom pattern

$$Period = \frac{1}{(Set\ frequency)} \times (2^N - 1) \times 32$$

N = 7, 9, 11, 15, 20, 23, 31

(Where *pulse width* $= \frac{1}{(Set\ frequency)} \times 32$, *plus pulse*)

2. Programmable pattern

(1) PRGM pattern

(a) Pattern Length ≤ 131,072

$$Period = \frac{1}{(Set\ frequency)} \times (least\ common\ multiple\ between\ 64\ and\ pattern\ length)$$

(Example 1) Pattern length = 8

$$\text{Period} = \frac{1}{(Set\ frequency)} \times 64$$

(Example 2) Pattern length = 10

$$\text{Period} = \frac{1}{(Set\ frequency)} \times 320$$

(b) Pattern Length > 131,072

$$\text{Period} = \frac{1}{(Set\ frequency)} \times (\text{pattern length})$$

(2) Zero-Subst pattern

$$Period = \frac{1}{(Set\ frequency)} \times 2^N \qquad N = 7, 9, 11, 15$$

(3) Pulse width

For any of the programmable patterns above, the *pulse with* $= \frac{1}{(Set\ frequency)} \times 32$.
The output signal polarity is plus pulse.

Instrument Name : MU163220A 3.2G Pulse Pattern Generator
Serial No. : _____
Ambient Temperature : _____°C
Ambient Humidity : _____%

- Trigger output interface

Output Level[V]	Standard[V]	Result
0.0	0.0 ±0.2	
-1.0	-1.0 ±0.2	

- Clock output interface

Output Level[V]	Standard[V]	Result
-0.9	-0.9 ±0.135	
-1.7	-1.7 ±0.255	
-3.0	-3.0 ±0.45	
-4.0	-4.0 ±0.6	
2.0	2.0 ±0.3	
1.0	1.0 ±0.15	
4.25 (Equipped with OPT02)	4.25 ±0.64	
3.25 (Equipped with OPT02)	3.25 ±0.49	

- Data output interface

Output Level[V]	Standard[V]	Result
-0.9	-0.9 ±0.135	
-1.7	-1.7 ±0.255	
-3.0	-3.0 ±0.45	
-4.0	-4.0 ±0.6	
2.0	2.0 ±0.3	
1.0	1.0 ±0.15	
4.25 (Equipped with OPT01)	4.25 ±0.64	
3.25 (Equipped with OPT01)	3.25 ±0.49	

- Burst trigger output interface

Output Level[V]	Standard[V]	Result
0.0	0.0 ±0.2	
-1.0	-1.0 ±0.2	

Instrument Name : MU163240A 3.2G Error Detector
Serial No. : _____
Ambient Temperature : _____°C
Ambient Humidity : _____%

- Trigger output interface

Output Level[V]	Standard[V]	Result
0.0	0.0 ±0.2	
-1.0	-1.0 ±0.2	

- Clock Counter

Frequency [Hz]	Standard[Hz]	Result
3.2 G	3.2 G ±32k	
50 M	50 M ±500	

We show here Initial settings of MU163220A 3.2G Pulse Pattern Generator and MU163240A 3.2G Error Detector. Setting items of unit which isn't inserted the main fame doesn't appear. To restore initial settings, select Initialize from the File menu. of the parent window.

Table 2 Initial settings

Panel	Group box	Setting item	Initial condition
Setup: Setup	Slot3&Slot4 Common Setting	Pattern	OFF
Setup: Clock I/F	3.2G PPG:	Output	ON
		Delay	0
		Level	VAR
		Duty	0
		Amplitude	1.00
		Offset	0.000
			Voh
	3.2G ED:	Polarity	POS
		Delay	0
		Termination	GND
Setup: Data I/F	3.2G PPG:	Output	ON
		Cross Point	50
		Level	VAR
		Amplitude	1.00
		Offset	0.000
			Voh
	3.2G ED:	Level	VAR
		Threshold	-0.500
		Termination	GND

Table 2 Initial setting (continued)

Panel	Group box	Setting item	Initial condition
Setup: Pattern	3.2G PPG	Pattern Output	Repeat
		Pattern	PRBS15
		Mark Ratio	1/2
		Bit Shift	1bit Shift
	(Zero-Subst is selected as the pattern type)	Pattern	Zero-Subst
		Pattern Length	2^7
		Zero-Length	7
		Logic	POS
	(PRGM is selected as the pattern type)	Pattern	PRGM
		Pattern Length	2
		Logic	POS
	Burst Setting	Mode	INT
		Burst Cycle	1000
		Enable Length	10
	3.2G ED	Pattern Input	Repeat
		Pattern	PRBS15
		Mark Ratio	1/2
		Bit Shift	1bit Shift
	(Zero-Subst is selected as the pattern type)	Pattern	Zero-Subst
		Pattern Length	2^7
		Zero-Length	7
		Logic	POS
	(PRGM is selected as the pattern type)	Pattern	PRGM
		Pattern Length	2
		Logic	POS
	Sync Setting	Auto Sync	ON
Setup: Trigger I/F	3.2G PPG:	Source	1/8 Clock Sync
	3.2G ED:	Source	1/8 Clock Sync
Setup: Utility	3.2G PPG	PRBS Logic	Mark Low
		PRGM Logic	Mark high
		Clock I/F	0 ohm
		Data I/F	0 ohm
	3.2G ED	PRBS Logic	Mark Low
		PRGM Logic	Mark high
		MEAS. Restart	Off

Table 2 Initial setting (continued)

Panel	Group box	Setting item	Initial condition
Test Menu: Measurement	—	Test Item	Error/Alarm
		MEAS. Mode	Repeat
		MEAS. Time	00:00:00:01
		Timed Start	OFF
	3.2G ED:	Error Type	Total
	MEAS. Condition	EI/%EFI Interval	100 ms
		Performance	ON
		Threshold EI/%EFI	ON
		Power Fail	ON
	—	Test Item	Eye Margin
		MEAS. Mode	Margin
			Phase & Threshold
		Error Threshold	1E-3
			Coarse
	—	Test Item	Eye Margin
		MEAS. Mode	Diagram
			16 points
		Error Threshold	1E-3
Test Menu: Error Addition	3.2G PPG	Rate	1E-3
		Addition Route	1

Table 2 Initial setting (continued)

Panel	Group box	Setting item	Initial condition
Result: ALL	—	Display	Current
		Time	Elapsed
Result: Zoom	—	Display	Current
		Time	Elapsed
	Display1	Item	Error Rate
	Display2	Item	Error Count
	Display3	Item	Sync Loss
	Display4	Item	Clock Loss
Result: Monitor		Display	Current
		Time	Elapsed
Customize	Setup1	Item	Frequency
		Unit	3.2G CG
	Setup2	Item	Clock/Amplitude
		Unit	3.2G PPG (Slot3)
	Setup3	Item	Clock/Delay
		Unit	3.2G ED (Slot4)
	Setup4	Item	OFF
		Unit	OFF
	Setup5	Item	OFF
		Unit	OFF
	Setup6	Item	OFF
		Unit	OFF
	Pattern Edit	Unit	3.2G PPG (Slot3)
	Result	Item	Error Rate

Anritsu Service and Sales offices

America

Anritsu Company (ACUS)

685-A Jarvis Drive Morgan Hill, CA
95037-2809, U.S.A.
Phone: +1-408-776-8300
Fax: +1-408-776-1738

Anritsu Company (ACUS-NJ) Dist.5

10 New Maple Avenue, P.O. Box 836
Pine Brook, NJ 07058-0836, U.S.A.
Phone: +1-973-227-8999
Fax: +1-973-575-0092

Anritsu Company (ACUS-Maryland) Dist.6

19630 Club House Road, #710
Gaithersburg, MD20879, U.S.A.
Phone: +1-301-590-0300
Fax: +1-301-216-2893

Anritsu Company (ACUS-Tx) NARO

1155 East Collins Blvd
Richardson, TX 75081, U.S.A.
Phone: +1-972-644-1777
Fax: +1-972-644-3416

Anritsu Electronics Ltd (ACCA)

5A-245 Matheson Blvd. East, Mississauga,
Ontario, L4Z 3C9, Canada
Phone: +1-905-890-7799
Fax: +1-905-890-2290

Anritsu Electronics Ltd (ACCA)

102-215 Stafford Road West Nepean,
Ontario, K2H 9C1, Canada
Phone: +1-613-828-4090
Fax: +1-613-828-5400

Anritsu Electronics Ltd (ACCA)

200-1405 Trans Canada Highway
Dorval, Quebec H9P 2V9, Canada
Phone: +1-514-421-3737
Fax: +1-514-685-9839

Anritsu Electronics Ltd (ACCA-Calgary)

Deerfoot Atrium, Suite 129, 6715-8th Street
N.E., Calgary, AB, T2E 7H7, Canada
Phone: +1-403-275-9855
Fax: +1-403-275-3609

Anritsu Eletrônica Ltd (ACBR)

Praia de Botafogo, 440-Sala 2401
CEP 22250-040, Rio de Janeiro, RJ, Brasil
Phone: +55-21-5276922
Fax: +55-21-537-1456

Anritsu Eletrônica Ltd (ACBR) Sao Paulo Branch Office

Praca Amadeu Amaral 27,
Primera Andar, Conj. 11, 12, 13, 14
Liberdade, Sao Paulo, Estado de
Sao Paulo, CEP : 01327-010, Brasil
Phone: +55-11-283-2511
Fax: +55-11-288-6940

Data Lab S.R.L

Edif. Ayfra, Pdte. Franco y Ayolas
Asuncion, Paraguay
Phone: +595-21-443-046
Fax: +595-21-441+935

Electro-Impex S.A.

P.O. Box 620-1000, San Jose, Costa Rica
Phone: +506-2-31-5701
Fax: +506-2-31-6531

Electronica 2000, S.A. DE C.V.

Blvd. Adolfo Lopez Mateos No.2016, Col.
Tlacopac, Del. Lopez Mateos, 01010,
Mexico D.F.
Phone: +525-662-8800
Fax: +525-662-5862

Electronic Engineering S.A.

Carretera de Circunvalavion, Sabanilla, Av
Novena, San Jose, Costa Rica
Phone: +506-2-25-8793
Fax: +506-2-25-1286

HDM Elquitecnica Cia. Ltda., Equitronics S.A.

Av. Republica de El Salvador, No.880,
Edificio, Almirante Colon 4to piso,
Quito, Ecuador
Phone: +593-9-704890
Fax: +593-2-48-2627

KRM Ingenieria Saciafs.

Viamonte 377,7° Piso 1053 Buenos Aires,
Argentina
Phone: +54-1-311-4165
Fax: +54-1-311-2297

SI Ltda.

E. Conchy Y Toro 65, Casilla 51888,
Santiago, Chile
Phone: +56-2-696-7534
Fax: +56-2-696-9665

Radiocom S.A.

Carrera 21 No.85-71, Conmutador
6100077, Santafe de Bogota, Columbia
Phone: +57-1-218-2054
Fax: +57-1-610-3272

Radiocomunicaciones cruz C.A.

Avda La Colina QTA. Elison, URB Colina
De Los Caobos, Caracas, Venezuela
Phone: +58-2-793-2322
Fax: +58-2-793-3429

Sakata Ingenieros S.A.

Av. Canaval Moreyra 840, Lima 27, Peru
Phone: +51-1225-7555
Fax: +51-1224-8148

Suministros Industriales S.A.

Casa 102, Calle 68 Este,
San Francisco, Balboa, Panama
Phone: +507-270-2328
Fax: +507-270-2329

Cabonorte S.A.

Colonia 1900, ESC. 603,
Montevideo, Uruguay
Phone: +598-2-430522
Fax: +598-2-418594

Europe

Anritsu Ltd (ACUK)

200 Capability Green, Luton
Bedfordshire, LU1 3LU, United Kingdom
Phone: +44-1582-433200
Fax: +44-1582-731303

Anritsu Ltd (ACUK-Manchester)

Kansas Avenue, Langworthy Park Salford,
Manchester M5 2GL, United Kingdom
Phone: +44-161-873-8041
Fax: +44-161-873-8040

Anritsu Ltd (ACUK-Bristol)

1230 Aztec West, Almondsbury
Bristol BS12 4SG, United Kingdom
Phone: +44-1454-615252
Fax: +44-1454-618017

Anritsu Ltd (ACUK-Livingston)

Unit 1, Knightsridge Industrial Estate
Turnbull Way, Knightsridge Livingston
EH54 8RB, United Kingdom
Phone: +44-1506-436111
Fax: +44-1506-436112

Anritsu GmbH (ACDE)

Grafenberger Allee 54-56
D-40237 Düsseldorf 1, Germany
Phone: +49-211-96855-0
Fax: +49-211-96855-55

Anritsu GmbH (ACDE-Sales Center South)

An der Steinernen Brücke 1 D-85757
Karlsfeld, Germany
Phone: +49-8131-3825-0
Fax: +49-8131-3825-95

Anritsu S.A. (ACFR)

9, Avenue du Québec ZA de Courtaboeuf 91951 Les Ulis Cedex, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

Anritsu S.A. (ACFR) (Toulouse Office)

Bureau de Toulouse
Région Centre Sud Ouest
Phone: +33-5-62070484
Fax: +33-5-62070668

Anritsu S.A. (ACFR) (Toulon Office)

Bureau de Toulon
Région Centre Sude Est
Phone: +33-4-94040264
Fax: +33-4-94040265

Anritsu S.A. (ACFR) (Rennes Office)

Bureau de Rennes
Région Ouest
Phone: +33-2-99521214
Fax: +33-2-99521224

Anritsu S.p.A. (ACIT)

Via Elio Vittorini, 129
00144 Roma EUR, Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

Anritsu S.p.A (ACIT-Milano)

C.D. Colleoni, Via Paracelso, 420041 AGRATE B.ZA(MI), Italy
Phone: +39-039-65-7021
Fax: +39-039-605-6396

Anritsu AB (ACSE)

BOTVID CENTER
145 84 STOCKHOLM, Sweden
Phone: +46-8-53470700
Fax: +46-8-53470730

Anritsu AB-Norway Branch Office (ACNO)

Leangbukta 40 1370 Asker. Norway
Phone: +47-66-901190
Fax: +47-66-901212

Anritsu AB-Finland Branch Office (ACFI)

Piispanportti 9 FIN-02240 Espoo, Finland
Phone: +358-9-435-522-0
Fax: +358-9-435-522-50

Anritsu AB-Denmark Branch Office (ACDK)

SOHOJ 11, DK-2690 KARLSLUNDE
Denmark
Phone: +45-46160330
Fax: +45-46155299

C.N. Rood B.V.

Cort van der Linddenstraat 11-13, 2288 EV Rijswijk ZH, The Netherlands
Phone: +31-70-3996360
Fax: +31-70-3905740

C.N. Rood SA/NV

Pontbeeklaan 45, 1731 Zellik, Belgium
Phone: +32-2-4668199
Fax: +32-2-4662500

ELSINCO GMBH

h.e. Strelbishte, str. Kotlenski Prohod, bl. 96/6/14, BG-1408 Sofia, Bulgaria
Phone: +359-2-58-61-31
Fax: +359-2-58-16-98

ELSINCO Praha Spol.

Novedvorska 994, CZ 142 21 Praha 4-Branik , Czecho Republic
Phone: +42-2-49-66-89
Fax: +42-2-49-54-83

ELSINCO Budapest KFT

Pannonia utca 8. IV/I.
H-1136 Budapest, Hungary
Phone: +36-1-269-18-50
Fax: +36-1-132-69-27

ELSINCO Polska Sp. Z.O.O

ul. Dziennikarska 6/1, PL 01 605 Warszawa, Poland
Phone: +48-22-39-69-79
Fax: +48-22-39-44-42

ELSINCO Bratislava Spol. s.r.o.

Kudlakova 4, SK 844 15 Bratislava, Slovakia
Phone: +42-7-784-165
Fax: +42-7-784-454

G'Amungason Co.

Skulagata 40, 101 Reykjavik, Iceland
Phone: +354-1-677887
Fax: +354-1-625045

GMP S.A.

Av. des Baumettes 19, CH-1020 Renens 1 Lausanne, Switzerland
Phone: +41-21-6348181
Fax: +41-21-6353295

Instrutek Oeriferi A/S

Christiansholmsgade DK-8700 Horsens, Denmark
Phone: +45-75-611100
Fax: +45-75-615658

Kostas Karayannis SA

58, Kapodistriou str., GR-142 35 Nea Ionia, Athens, Greece
Phone: +30-1-680-0460-4
Fax: +30-1-685-3522

Omnitecnica S.A.

Estrada Alfragide 2700 Amadora, Portugal
Phone: +351-1-471-55-17
Fax: +351-1-471-36-10

Pema Ltd.

Doromiskin, Dundalk, Co. Louth, Ireland
Phone: +353-42-72899
Fax: +353-42-72376

Unitronics S.A.

Plaza Espana 18, Torre de Madrid, Pl. 12-ofc. 9, 28019 Madrid, Spain
Phone: +34-1-5425204
Fax: +34-1-5591957

Wien CHALL GMBH

Krichbaumgasse 25, 1120 Wien, Austria
Phone: +43-1-811-55140
Fax: +43-1-811-55180

Asia, Pacific and Africa

Anritsu Private Ltd (ACSG)

6, New Industrial Rd., #06-01/02
Hoe Huat Industrial Building
Singapore 536199
Phone: 65-282-2400
Fax: 65-282-2533

Anritsu Company Ltd (ACHK)

Suite 719, 7/F., Chinachem Golden Plaza, 77 Mody Road, Tsimshatsui East, Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

Anritsu Company Incorporated (ACTW)

6F, 96, Sec. 3, Chien Kou North Rd.
Taipei, Taiwan
Phone: +886-2-2515-6050
Fax: +886-2-2509-5519

Anritsu Corporation, Ltd (ACKR) Head Office

14F Hyunjuk Bldg. 832-41, Yeoksam-dong, Kangnam-ku, Seoul, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604~5

Anritsu Proprietary Ltd (ACAU)

Unit 3, 170, Forster Rd., Mt. Waverley Victoria 3149, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

Anritsu Proprietary Ltd (ACAU)

Suite 304/2 Rowe Street Eastwood NSW 2122, Australia
Phone: +61-2-9874-9044
Fax: +61-2-9874-9920

Anritsu Corporation Beijing Liaison Office

Room No.1515, Beijing Fortune Bldg. 5
Dong-San-Huan-Bei-Lu Chao-Yang
District Beijing 100004, P.R. China
Phone: +86-10-6590-9230~9234
Fax: +86-10-6590-9235

Anritsu Corporation Shanghai Liaison Office

No.511 Shanghai Jing Tai Building
No.58, Mao Ming Nan Rd. Sanghai
200020 P.R. China
Phone: +86-21-6415-5137
Fax: +86-21-6472-6677

Anritsu Company Ltd Guangzhou Representative Office

Room 720, 7/F., Dongshan Plaza,
69 XianLie Road Central.
Guangzhou 510095 P.R. China
Phone: +86-20-8732-2231
Fax: +86-20-8732-2230

Anritsu Corporation New Delhi Liaison Office

Room No. 508, Prakash Deep,
7 Tolstoy Marg, New Delhi-110001, India
Phone: +91-11-331-9133
Fax: +91-11-371-3948

Associated Electric Trading Corp.

Zia Chambers, 25 McLeod Rd., Lahore,
Pakistan
Phone: +92-42-722-1716
Fax: +92-42-7221456

Chris Radiovision Ltd.

Kouloumbris Building, 23 Crete Street,
P.O. Box 1989, Nicosia, Cyprus
Phone: +357-2-466121
Fax: +357-2-365177

Electronic Equipment Marketing Co.

P.O. Box 3750, Riyadh 11481,
Saudi Arabia
Phone: +966-1-4771650
Fax: +966-1-4785140

Etecsa (Pty) Ltd.

1st Floor Montrose Place, Waterfall Park,
Bekker Rd., Midrand, South Africa
Phone: +27-11-315-1366
Fax: +27-11-315-2175

Giza Systems Engineering

2 El Mesaha Square, Dokki A.R.E.,
P.O.Box 1913, Cairo 11511, Egypt
Phone: +20-2-349-0140
Fax: +20-2-360-9932

Infotechs Ltd.

23-1, Jaya Rd., Colombo 4, Sri Lanka
Phone: +94-1-580088
Fax: +94-1-584644

Inter Muhendislik Danismanlik ve Ticaret A.S.

Farabi Sokak No: 24/14
Cankaya-06680 Ankara, Turkey
Phone: +90-312-4277792
Fax: +90-312-4277937

Jasmine Telecom Systems Co., Ltd.

333 Laksi Plaza 6th Floor, Tower 2,
Chaengwatana Rd., Donmuang, Bangkok
10210, Thailand
Phone: +66-2-576-0200
Fax: +66-2-576-0420

Meera Agencies (P) Ltd.

A-23 Hauz Khas New Delhi 110 016, India
Phone: +91-11-685-3959
Fax: +91-11-685-2275

UAE Utmost Electronics Trading (L.L.C.)

P.O. Box 41175 Abu Dhabi, U.A.E.
Phone: +971-2-768909
Fax: +971-2-768907

Martwell Electronics Pvt., Ltd

3rd Floor, Francis House, Stanley Avenue,
P.O. Box 1737, Harare, Zimbabwe
Phone: +263-4-793578
Fax: +263-4-737956

Mandeno Electronic Equip. Co.

463 Mt. Eden Rd. Mt. Eden,
Aukland 1003, New Zealand
Phone: +64-9-630-7871
Fax: +64-9-630-1720

National Projects and Technology Co. L.L.C

P.O. Box 97, Wadi Al Kabir, Postal Code 117,
Sultanate of Oman
Phone: +968-791704
Fax: +968-791697

O'Connors Engineering & Trading (Malaysia) Bhd

3rd Floor, Wisma Siong Huat,
Lot 13, Jalan 51A/223
46100 Petaling Jaya,
Selangor Darul Ehsan, Malaysia
Phone: +60-3-757-2828
Fax: +60-3-757-7871

P.T. Subur Sakti Putera

Jalan Musi No.32, Jakarta 10150,
Indonesia
Phone: +62-21-3803644
Fax: +62-21-3845043

Qatar Communications Ltd.

P.O. Box 2481, Doha, Qatar
Phone: +974-424347
Fax: +974-324777

Trading and Agency Services

P.O. Box 1884, Doha, Qater
Phone: +974-432212
Fax: +974-422255

Rajab & Silsilah & Co.

P.O. Box 203 Jeddah 21411, Saudi Arabia
Phone: +966-2-6610006
Fax: +966-2-6610558

Salritsu International Trading Corporation

50B ODC International Plaza
Condominium, 219 Salcedo St., Legaspi
Village, Makati, Metro Manila, Philippines
Phone: +63-2-816-2646
Fax: +63-2-815-0986

Sedel

24, 26, Bd, Resistance, Casablanca,
Morocco
Phone: +212-2-302444
Fax: +212-2-449311

Superior Electronics Associated

B-98 Block H, North Nasimabad, Karachi-
33, Pakistan
Phone: +92-21-613655

Tareq Company

P.O. Box 20506 Safat, 13066 Safat, Kuwait
Phone: +965-2336-100
Fax: +965-2437-700

Tech-Cent Ltd.

Haarad St. No.7, Ramat Haahayal,
Tel-Aviv 69710, Israel
Phone: +972-3-6478563
Fax: +972-3-6478334

Test

Sehit Adem Yavuz Sokak No.6/17,
Kizilay-Ankara, Turkey
Phone: +90-41-71086
Fax: +90-41-74384

Japan

Head Office

5-10-27, Minamiazabu, Minato-ku,
Tokyo 106-8570
Phone: 03-3446-1111
Fax: 03-3442-0235

Atsugi Factory

1800, Onna, Atsugi-si, Kanagawa 243-8555
Phone: 046-223-1111
Fax: 046-225-8379

If you have any comments on this manual, please e-mail them to Manual-support@zz.anritsu.co.jp.

www.manualsplus.com
1030561